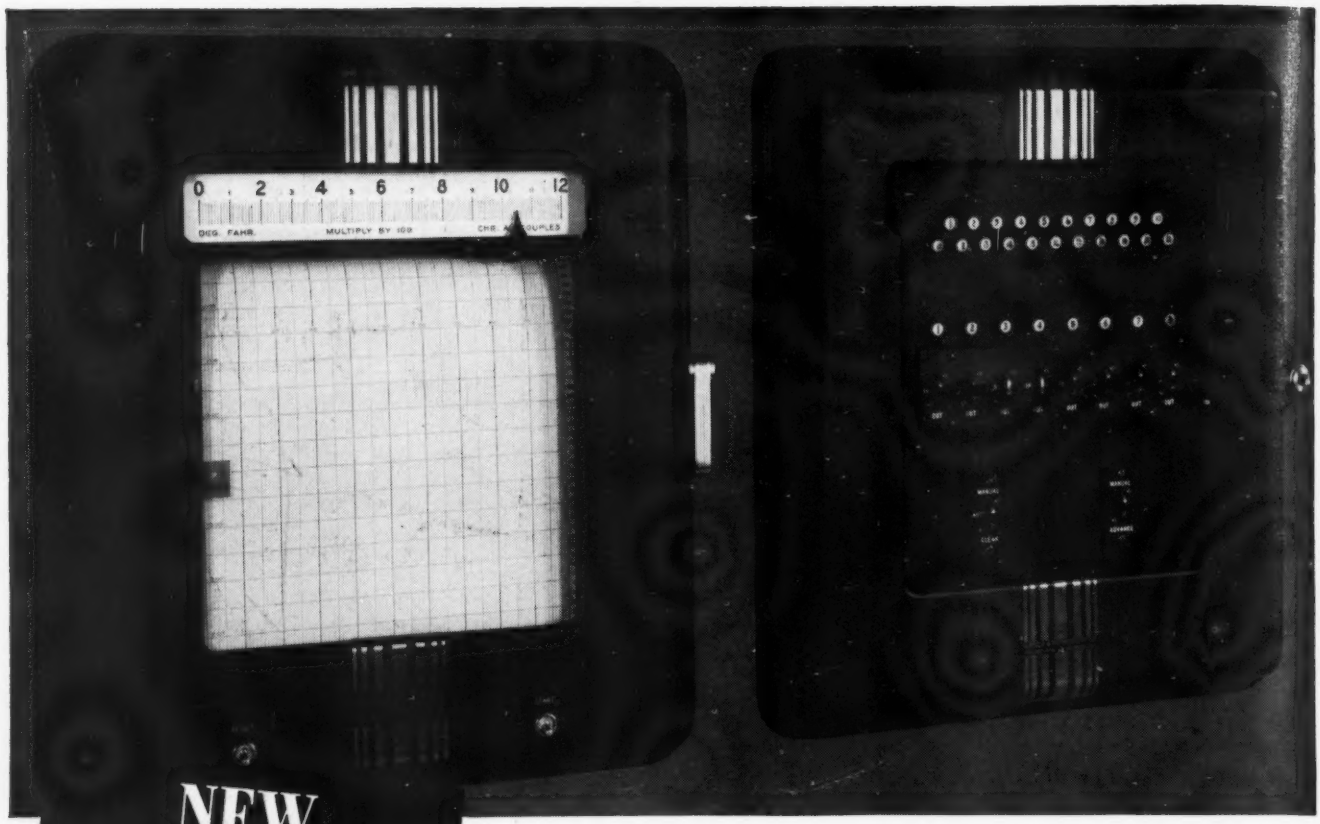
POWER

NOVEMBER 1948

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

IN THIS ISSUE: How one central station overcame a capacity reduction from lower fuel quality by including smoke topping unit in major extension, p 64; new turbine control system in industrial demand within limits, avoi maintains process pressure



NEW PROTECTOR FOR BOILERS

Checks 160 Tube Temperatures In Only 10.6 Minutes!

Remarkably fast, this new Speedomax equipment offers a definite advance in protection for large boilers. With it, the shift operator can "tour" the temperatures of 160 tubes in a little less than eleven minutes. He can stand and watch the readings as they are automatically indicated; or Speedomax will record them for later examination and for the shift log.

In either case, readings are supplied in such rapid rotation that it is generally possible to determine the exact point at which any high or low temperature first develops, even though the condition may later spread to other points. This thus helps both to detect and to isolate trouble.

allation procedure is familiar to most power he power company's staff simply makes up d attaches them to the tubes which they he most useful temperature readings. uples, at points outside the gas passages, are of course usually included in the installation. Couples are connected to the Speedomax equipment in 8 banks of 20 each, and appropriate alarms are included.

Records When Desired

The Speedomax automatically measures these temperatures at a rate of one every 4 seconds. Signal lights wink on for each couple, and as long as temperature remains correct the instrument merely indicates . . . does not record. It can be made to record at any time, however, by merely throwing a switch. Or if any temperature reaches its predetermined limit, an alarm sounds and the Speedomax automatically records until switched off. Also, any bank or banks of couples can be switched out at any time, thus concentrating on areas of special interest.

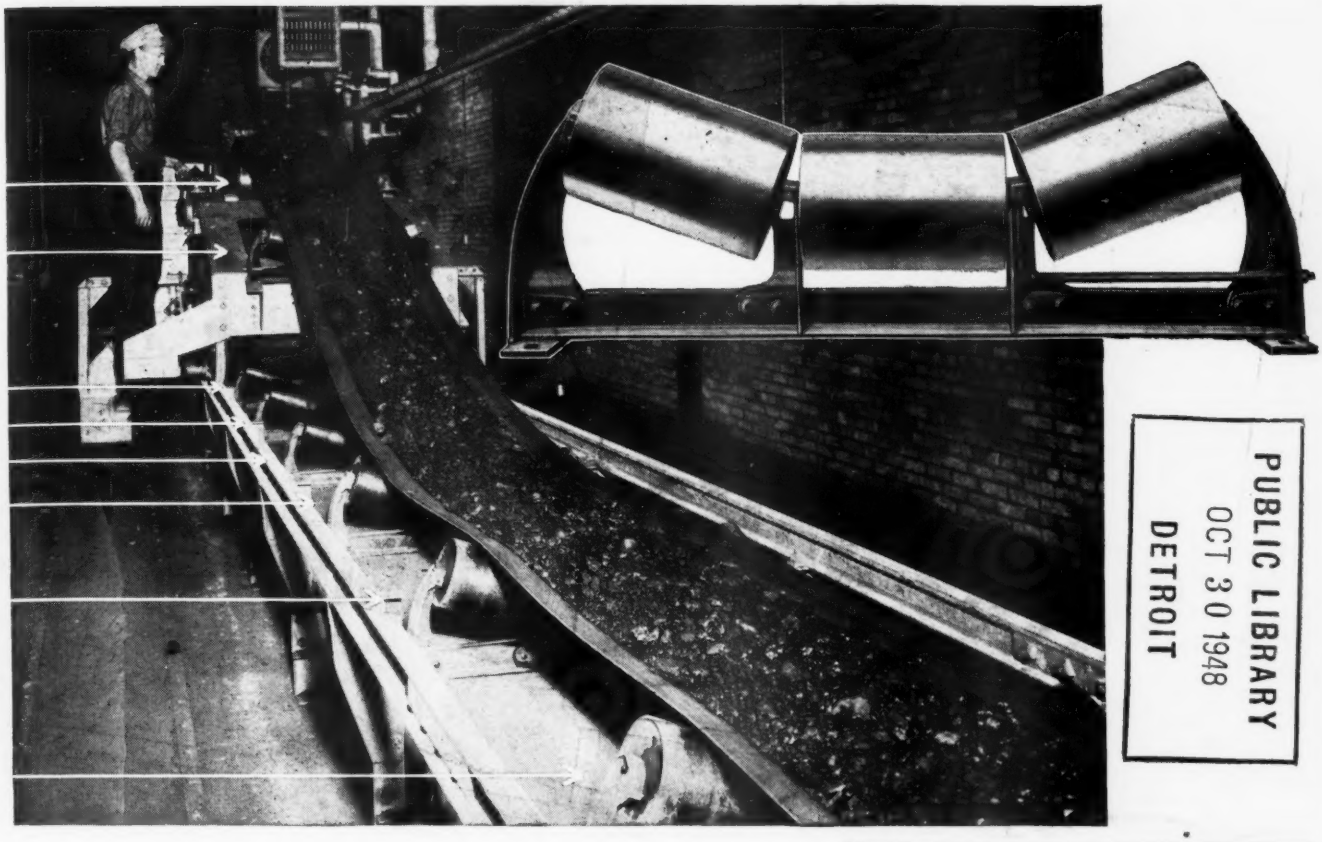
For further information about these equipments, please write Leeds & Northrup Co., 4910 Stenton Avenue, Philadelphia 44, Pa.

The Same Equipment Can Be Used For Turbine and Generator-Bearing Temperatures

G INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

EDS & NORTHRUP CO.

ce and Industry," "The Engineer Review," "The Engineer" and "The Stationary Engineer", November, 1948, dditional Directory number in June. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North ive offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter August 25, 1936, at Printed in U. S. A. Allow at least ten days for change of address. Subscription rates—U. S. and U. S. c per copy. Canada $6 for one year, $9 for two years. Pan American Countries, $10 for one year, $16 for , $25 for two year. Please indicate position and company connection on all subscription orders.



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DETROIT

Link-Belt Standardized Design Cuts Belt Conveying Costs

In the Link-Belt "100" series belt conveyor idlers, we believe that we have achieved the ultimate in design and performance, with evolution of engineering features progressively since 1896. These features cut conveying costs by reducing maintenance, giving longer service, and permitting the greatest simplification.

In addition to idlers, Link-Belt builds a great variety of standardized design conveyor elements and accessories such as: belt and apron feeders for uniform loading; trippers for intermediate discharge or distribution; drives using gears, reducers and chains; terminal machinery; supporting structures and enclosures.

We are at your service for complete conveyor systems, or individual equipment, to suit your requirements.

LINK-BELT COMPANY

Chicago 9, Philadelphia 40, Pittsburgh 13, Wilkes-Barre, Huntington, W. Va., Atlanta, Dallas 1, Minneapolis 5, Denver 2, Kansas City 6, Mo., Los Angeles 33, San Francisco 24, Cleveland 13, Indianapolis 6, Detroit 4, St. Louis 1, Seattle 4, Vancouver, Toronto 8.

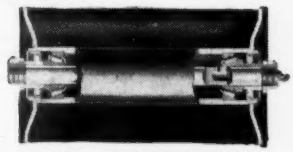
11.212

LINK-BELT

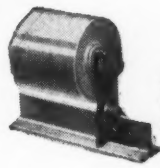
BELT CONVEYOR EQUIPMENT

IDLERS • TRIPPERS • BELTS • PULLEYS • BEARINGS • DRIVES

Grease-in—Dirt-out Seal prevents harmful foreign matter from reaching bearings — conserves lubricant — prolongs bearing life.



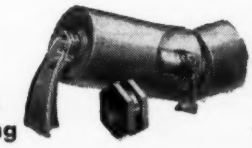
Rolls made with smooth rounded-edge outer shell of uniform thickness, and a full-length steel central tube, both continuous-welded to dished steel heads to form sturdy, well-balanced integral units.



Strong Brackets Support the Rolls

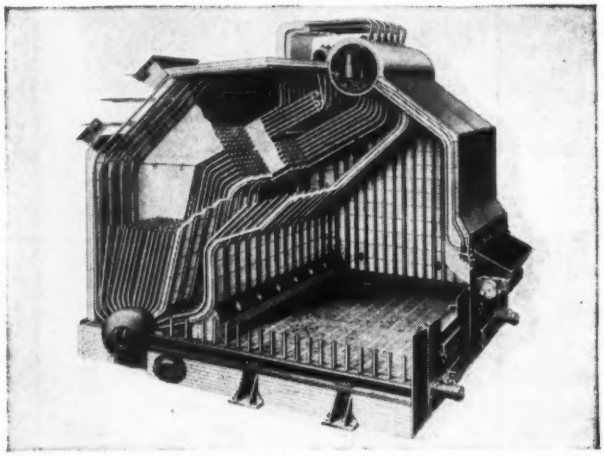
Supporting brackets are tough malleable iron in reinforced T-section to withstand load and impact.

Interlocking Nuts and Yokes Prevent Brackets from Spreading

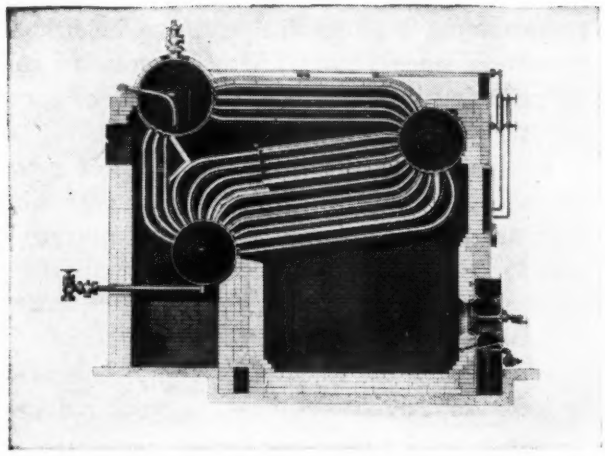


Impact Idlers with Rubber Treads

Interchangeable with steel rolls this type provides a Cushion at loading points to protect idlers and preserve the belt — A good investment where heavy lump materials are handled.



B&W Integral-Furnace Boiler, Type FF with completely water-cooled furnace, for high duty power and process services.



Type H Stirling Boiler usually for low-headroom installations where oil-refractory furnaces are suitable; water cooling may be added.

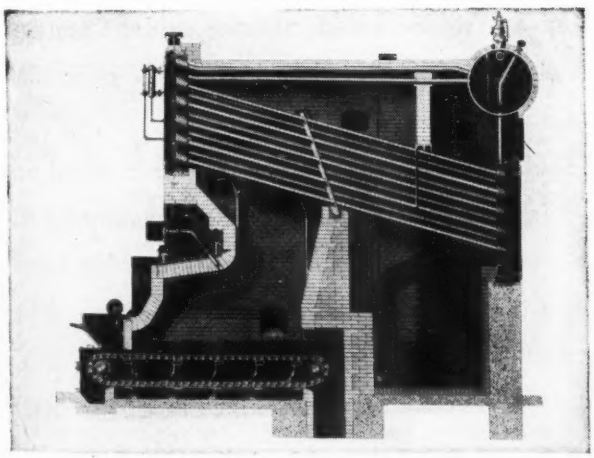
* ALL are fully coordinated, flexible units—from fuel burning equipment to breechings and stacks — built and installed under undivided responsibility.
* ALL are time-tested, performance-proved units of simplified design and standardized manufacture.
* ALL fully meet modern requirements as to fuel flexibility, compactness, ease of operation, fast-steaming and ability to take sudden load swings.
* ALL sustain high operating efficiency over their wide range of output, and generate steam of satisfactory quality at all ratings.
* ALL have provision for adding superheaters.

...the B&W CUBS*

In Type FF Integral-Furnace, Type H Stirling, and Design 32 Boilers, B&W offers a selection of three different units designed expressly for steam requirements from 10,000 to 60,000 lb. per hr. at pressures above 160 psi. Each has distinctive features that make it the best buy in boilers for specific service conditions, yet ALL three are outstanding for their compactness —maximum steaming capacity in minimum space; and for complete coordination of components into highly efficient units of simplified design and standardized construction.

***Complete Unit BoilerS**

Each as much a package boiler as any unit its capacity can be.



B&W Design 32 Boiler for low-headroom installations where simplicity of straight-tube type is desired.

BABCOCK & WILCOX

G-414

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GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
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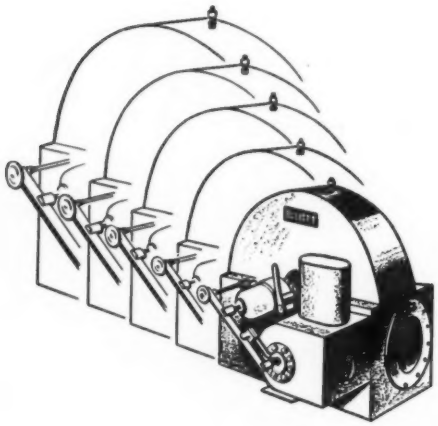
FOR POWER PLANTS—B&W, Open-Pass, Radiant, Integral-Furnace, Cross-Drum, Stirling and Waste-Heat Stationary Boilers . . . Air Heaters . . . Economizers . . . Superheaters . . . Water-Cooled Furnaces . . . Oil, Gas & Multifuel Burners . . . Chain-Grate Stokers . . . Stacks and Breechings . . . Seamless & Welded Tubes for All Pressure and Mechanical Applications . . . Refractories . . . Chemical Recovery Units . . . Alloy Castings. OTHER B&W PRODUCTS—Marine Boilers . . . Pressure Vessels . . . Process Equipment.

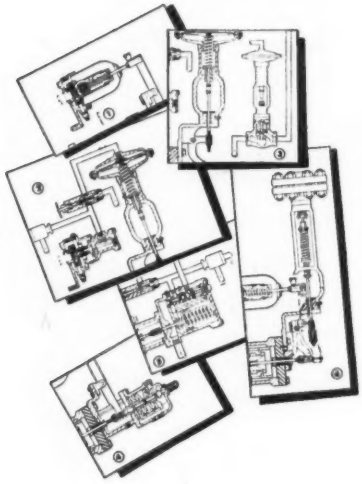
Every way, it *clicks*



Looking for just the *right* turbine to meet *all* your specifications without compromise? Here is a standardized line of turbines with such a wide choice of permissible modifications as to give you a unit that's practically tailored to the job.

5 FRAME SIZES

covering horsepower range from 1 to 2000. Exhaust pressures to 250 psig. Speed range from 800 to 6000 rpm. All with permissible inlet pressure of 600 psig, and inlet temperature of 750 F. For low pressure, construction is of cast iron. For high pressures and temperatures, cast steel is used.



6 ELECTIVE GOVERNORS

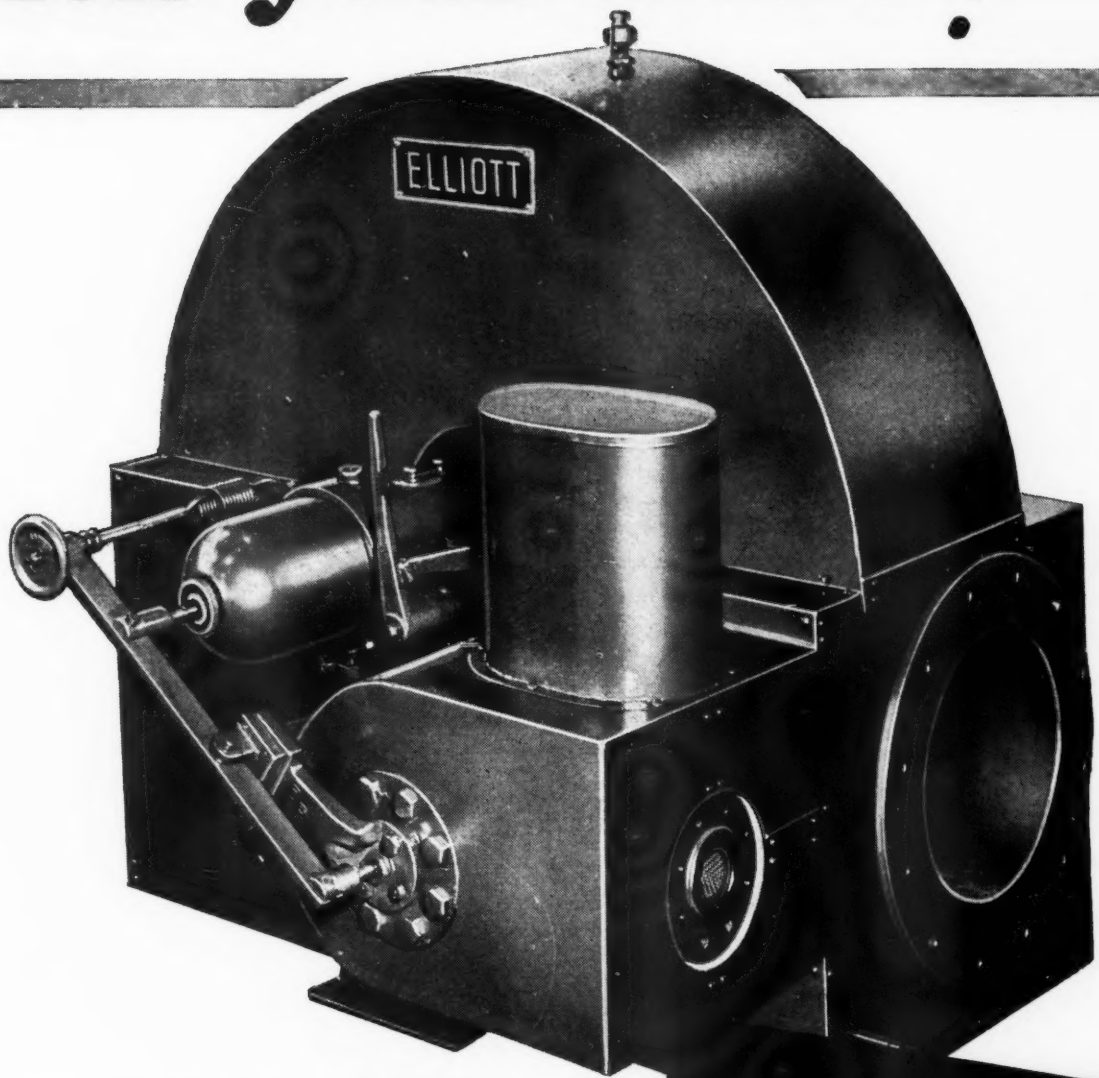
In addition to the standard independent emergency governor, any of these six governors is available: (1) Constant speed mechanical shaft . . . (2) Variable speed orifice type . . . (3) Variable speed orifice type with remote control . . . (4) Constant-speed oil relay type . . . (5) Variable-speed oil relay type . . . (6) Built-in constant or differential pressure pump type.

With this wide choice of governors, you can get constant speed, normal regulation, close regulation or any combination of these.

For full details and fully informative Bulletin PH-16, address TECHNICAL DATA DEPT.,

Elliott

with your need!



ELLIOTT YR TURBINES

H-720

OTHER AVAILABLE MODIFICATIONS

Two hand valves for part load economy . . . Speed changer, hand-operated, or motor- and hand-operated, adjusted to within plus or minus 10 per cent. . . . High exhaust pressure trip, or remote control electrical trip, actuating emergency trip valve . . . Throttling type emergency trip valve for hand throttling . . . Gland seal piping for condensing operation . . . Gland sealing for gas operation.

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STEAM TURBINES • GENERATORS • MOTORS • CONDENSERS
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CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
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see exactly what is happening beyond range of vision . . . around corners . . . through walls

The Diamond "Utiliscope" uses television to provide a clear, exact picture of something currently taking place at a remote or inaccessible point.

For example, in the Hell Gate Station of Consolidated Edison, New York City, it brings to the control room the instantaneous and unmistakable image of the water level in a boiler water gauge that is 8 floors above and 325 feet away in another building.

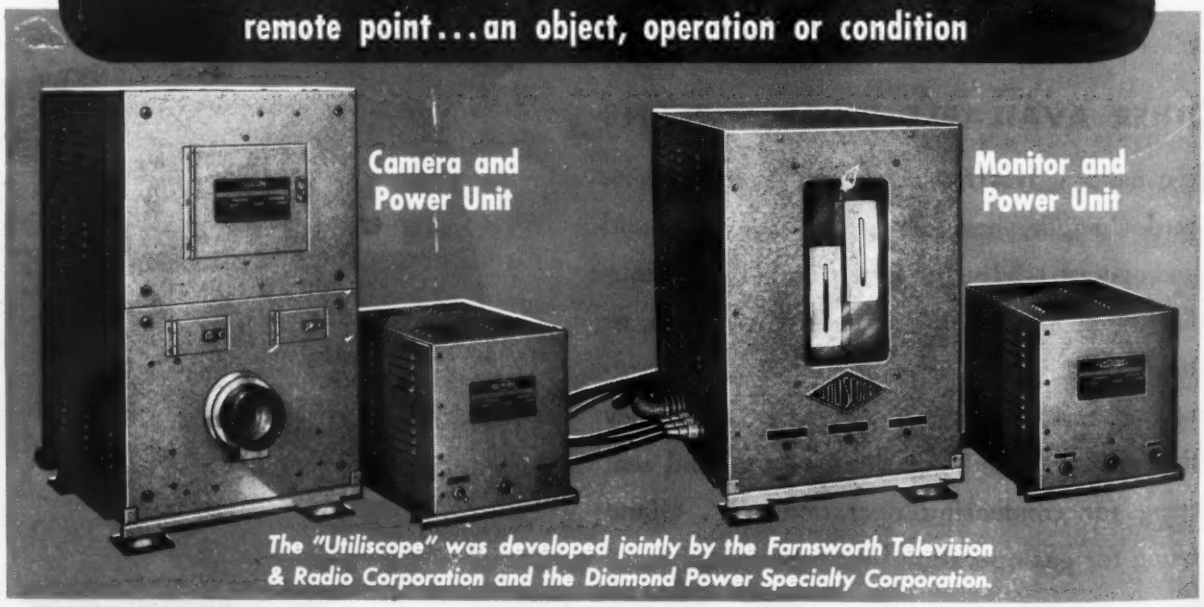
A continuous picture is produced by 60 individual image fields each second (sound motion pictures have only 48 per second). Every change in whatever is viewed is reproduced faithfully and instantly . . . there is no measurable time lag.

Construction is simple and rugged . . . the Diamond "Utiliscope" has fewer tubes than a good radio set and is built for continuous operation at temperatures up to 150° F. Installation requires no special skill; instructions can be followed by anyone using ordinary care.

Exceptional stability is another important characteristic of the "Utiliscope". This permits simplification of control to the point where only a screw driver is needed for adjustment of focus, brilliance and contrast to suit individual preference.

If you must see *exactly* and *instantly* something that is happening beyond the range of vision, around corners and through walls . . . or that is perilous to human life to observe directly . . . the "Utiliscope" is probably the answer to your problem. Ask for Bulletin No. 1013.

For exactly, simultaneously and continuously picturing at a remote point . . . an object, operation or condition



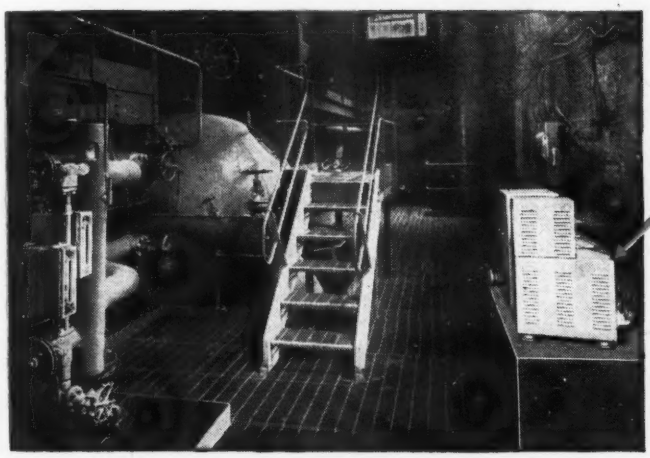
The "Utiliscope" was developed jointly by the Farnsworth Television & Radio Corporation and the Diamond Power Specialty Corporation.

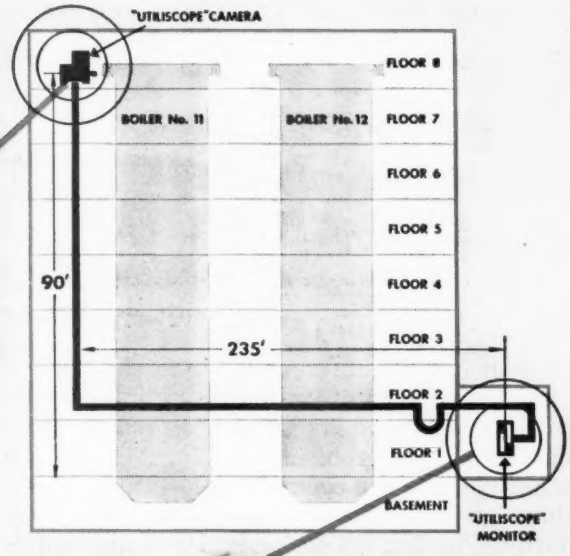
DIAMOND POWER SPECIALTY CORP. • Detroit 31, Mich.

DIAMOND

with the "UTILISCOPE"

(TELEVISION IN INDUSTRY)





(Above) "Utiliscope" camera scans water level gauge of Boiler No. 11 at Hell Gate Station of Consolidated Edison in New York City. Eight floors below and 325 feet distant, the "Utiliscope" monitor (viewer) is mounted in the instrument panel in the control room. Small changes in water level are immediately apparent to the operators at all times.

OTHER USES

To observe radioactive materials behind barriers.

To reproduce images of maps, charts, etc.

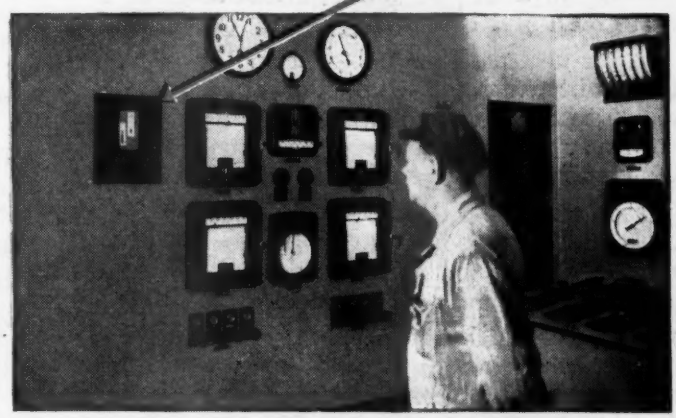
To observe coal feed to pulverizers or stokers.

To observe burner ignition, secondary combustion, slag flow, etc.

To observe presence of smoke from stacks.

To reproduce readings of electric meters, liquid level or temperature gauges, etc. located at remote or inaccessible places.

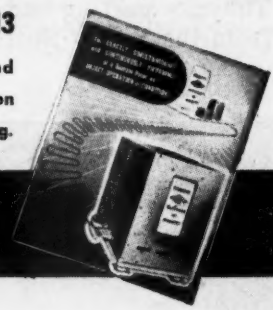
To observe conditions in steel furnaces.



"Utiliscope"—Registered U. S. Patent Office

WRITE FOR BULLETIN No. 1013

This bulletin illustrates the Diamond "Utiliscope" and describes its operation in detail. A copy is yours for the asking.



DIAMOND SPECIALTY LIMITED · Windsor, Ontario

Is a Standardized Boiler Unit THE BEST ANSWER for your steam needs?

Sure – your plant is different. Your combination of load, pressure and temperature requirements, fuel situation and physical layout – when put together – probably poses a problem different from that of any other plant in the country. *But* – can all these variables be met by a steam generating unit of standardized design without sacrifice of any worthwhile advantage and with important benefits of economy in both first cost and operating expense?

The answer is a positive YES – providing your capacity requirements fall within the broad range from 15,000 to 300,000 (or more) lb of steam per hr – the capacity range of the VU family (illustrated on the opposite page).

The reason that the VU family can meet – with standardized design – your particular conditions and requirements may be simply stated.

FIRST – let's take load, pressure and temperature conditions. VU Units are in service – many for more than 10 years – operating at a variety of steam pressures up to 1,000 psi and at temperatures to 900 F and above. They are meeting load conditions that vary from the widely fluctuating demands of certain process industries to the above-capacity requirements of overloaded steam plants.

NEXT – let's consider your fuel situation. The VU family is versatile. No matter what fuel – oil, gas or coal, alone or in various combinations – the VU furnace design is adaptable to the most suitable type of firing equipment.

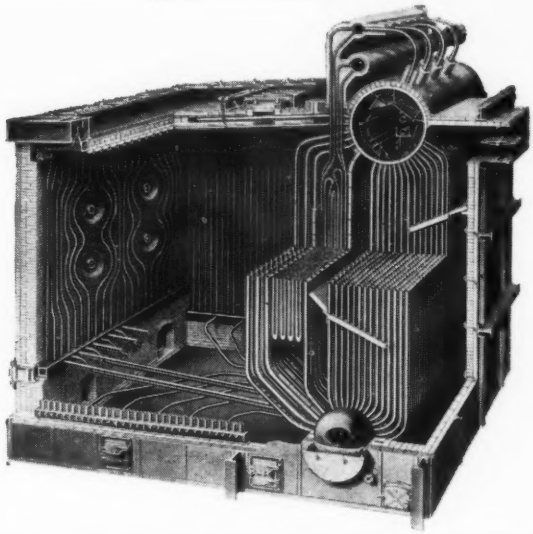
AND FINALLY – let's take a look at physical layout, i.e., space conditions. With the integral, water-cooled furnace in front of the boiler surface instead of below it, head room is seldom a problem. Since width, depth and distance between drum centers are variable in standard increments, virtually any space situation can be met. And you can have deep ash pits or shallow as required, economizer and/or air heater surface if necessary.

Industry – world-wide – has purchased units of the VU family with an aggregate capacity of more than 88,000,000 lb of steam per hr. So you can select a VU Unit with confidence that you will get all the economic benefits of service-proved, standardized design in an installation suited to your particular conditions. B-265

C-E

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

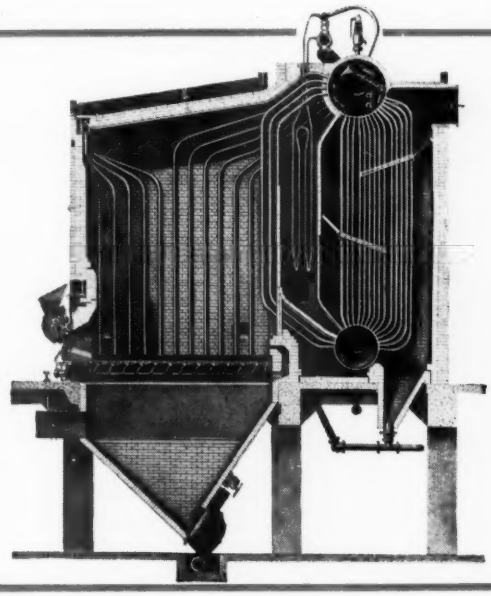


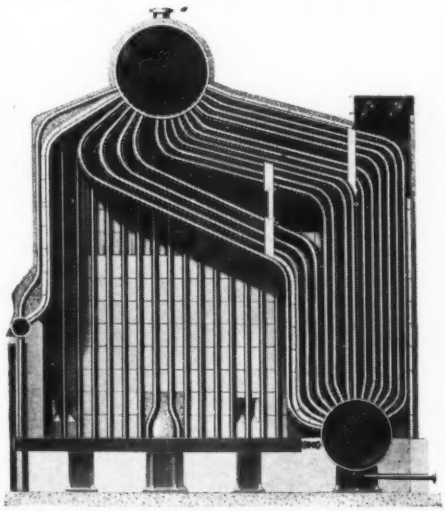
Type VU Steam Generator (for the higher capacity range)

This unit, the original VU design, may be fired by pulverized coal, oil or gas, or any combination of these fuels. Available for capacities up to 300,000, or more, lb of steam per hr, pressures up to 1000 psi and steam temperatures up to 900 F, or higher. Furnace bottom may be as shown or may be of hopper type. Economizer or air heater surface may be added.

Type VU Steam Generator (for the middle capacity range)

In this VU design, shown equipped with a C-E Spreader Stoker, the furnace proportions and arrangement of water wall surfaces may be adapted for firing by any type of mechanical stoker. Design is also adaptable for firing by oil or gas. Economizer or air heater surface may be added. Approximate capacity range 25,000 to 100,000, or more, lb per hr.





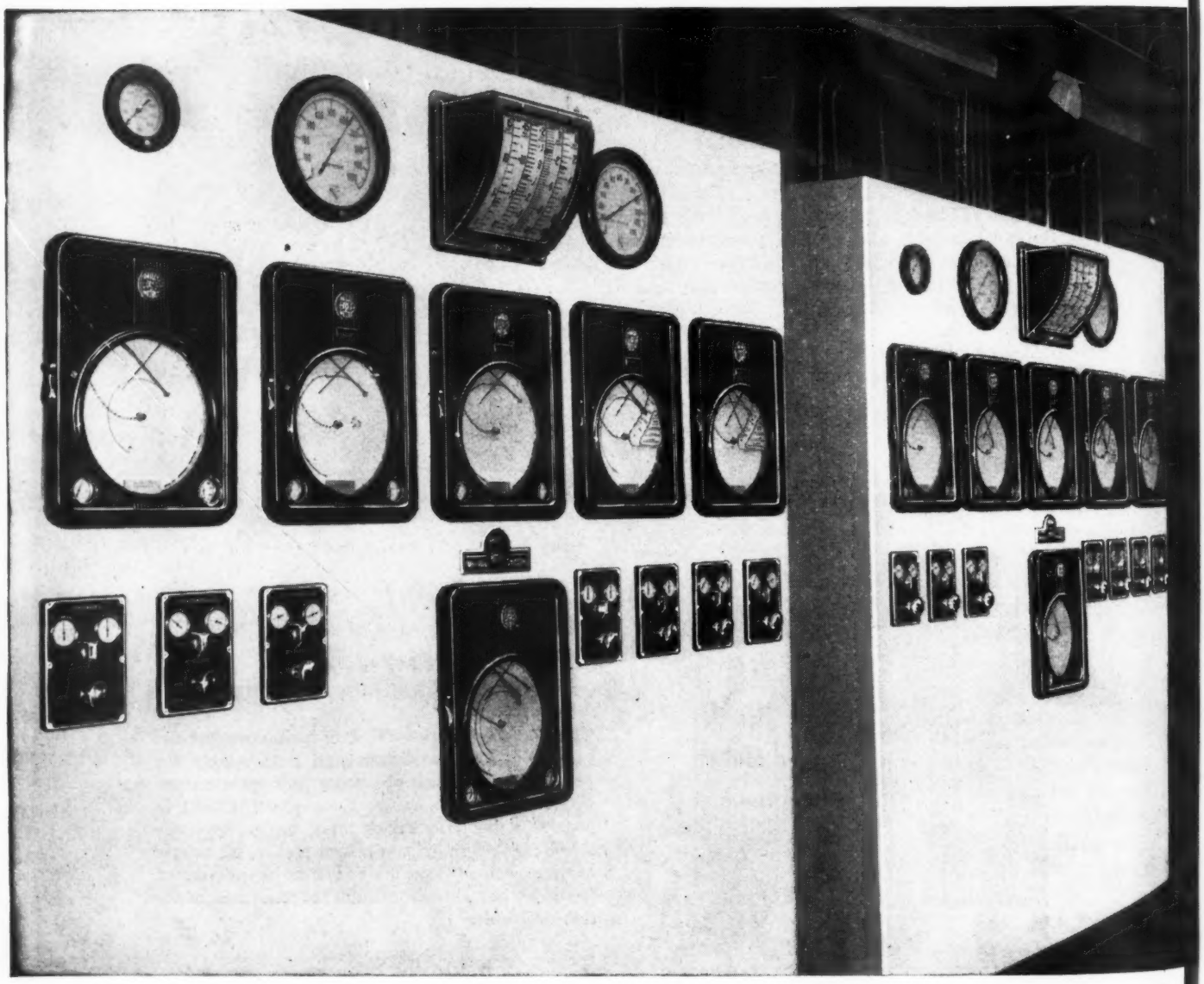
C-E Package Boiler (for the lower capacity range)

This member of the VU family is designed for industrial load conditions and particularly for plants having small operating and maintenance forces. Capacities range from about 15,000 to 50,000 lb per hr. Firing may be by spreader stoker, single-retort underfeed stoker, oil or gas burners. Any of these methods may be substituted for any other, should fuel market conditions make this desirable.

ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N. Y.

some Btu's are always



Btu's receive no vacations from this co-ordinated Bailey boiler control system on a 135,000 lb. per hr. capacity gas and oil-fired boiler. Controls for combustion, feed water, steam temperature and flue gas temperature are included on this panel.

Branches in: Boston, New York, Schenectady, Philadelphia, Buffalo, Pittsburgh, Charlotte, Cleveland, Detroit, Cincinnati, Atlanta,

on vacation

Yes, some Btu's are always on vacation. Your problem is to prevent too many from getting the habit. Loafing Btu's produce no power. You have to make them work. Then you get low power costs. And that is what you get when you install the Bailey co-ordinated boiler control system.

The Bailey system reduces fuel consumption per pound of steam generated. Combustion, feed water, steam temperature, heater levels, pump speeds and other factors are co-ordinated. Safety of operation is increased—continuity of service is improved. You convert the maximum number of Btu's into power and get all the efficiency your boiler was designed to deliver.

One thing to remember. The Bailey system is not delivered as a standard package. Each one is designed and engineered to the specific job on which it is to be used. That's why it functions so efficiently.

If you are looking for low cost power, it will pay you to call our nearest office.

A-106-2

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO

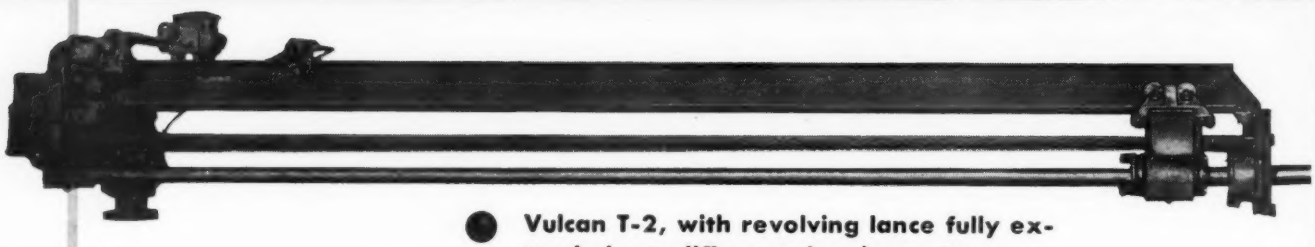
BAILEY METER COMPANY LIMITED, MONTREAL, CANADA

Controls for Steam Plants

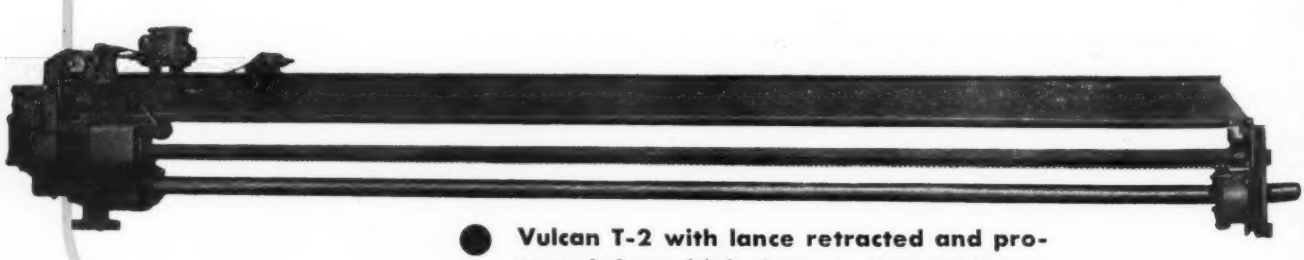
COMBUSTION • FEED WATER • TEMPERATURE
PRESSURE • LIQUID LEVEL • FEED PUMPS

Chicago, Milwaukee, St. Louis, New Orleans, St. Paul, Kansas City, Houston, Denver, Los Angeles, Seattle, San Francisco

HERE'S WHY



● **Vulcan T-2, with revolving lance fully extended, cuts different cleaning patterns on forward and retracting cycles.**



● **Vulcan T-2 with lance retracted and protected from high furnace temperatures, while not in action.**

more than 500 VULCAN

T-2 Long Retractable Soot Blowers ARE IN SERVICE or on ORDER

Fully Automatic... Simple push button control... All parts easily accessible... Gears sealed in oil... Ball or roller bearing throughout . . . Non-corrosive stationary feed tube... Flanged lance... Alloy nozzle head with dynamically balanced jets... Dual motor drive... Uses either steam or air as cleaning medium... Can be installed at any angle or inverted... Shipped complete ready for steam or air connection.

VULCAN, T-2 In a class by Itself

Wherever high furnace temperatures, hard-to-reach locations or difficult cleaning conditions exist, look to Vulcan T-2, the long retractable blower. With over 500 in service or on order, T-2's are in a class by themselves.

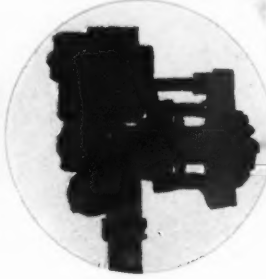
Install T-2's at any angle, inverted or upright, outdoors or indoors, or in the dirtiest locations. The sealed traversing and control mechanism assures trouble free operation. The dual motor drive not only permits double cleaning action, but keeps maintenance down by decreasing lance warpage and increasing packing life

• • •

T-2's are shipped complete . requiring only steam or air connections. They operate at the touch of a button. Vulcan T-2's ask for your tough cleaning jobs. Outline your problem. Write for Bulletin No. 474 today.

VULCAN SOOT BLOWER CORPORATION • DUBOIS, PENNSYLVANIA

VULCAN
STEAM OR AIR

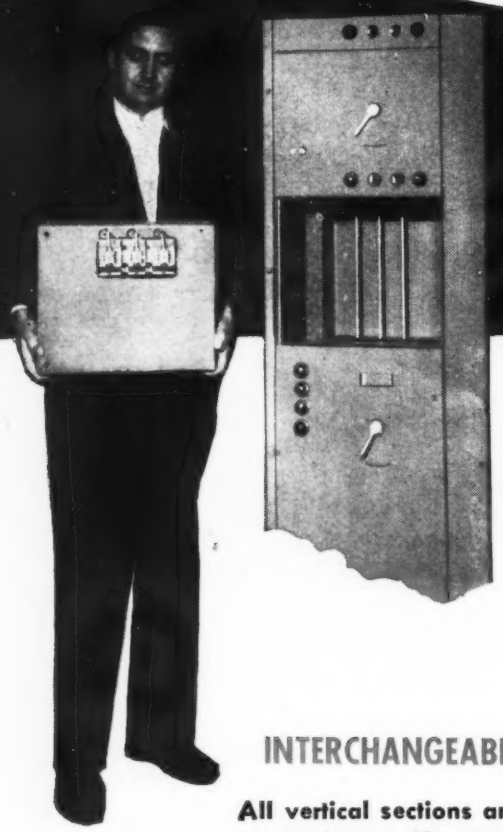


SOOT BLOWERS

"Clothespin Contact"...

in the new G-E Motor Control Center

marks new advance in starter design



No wiring from starter to bus necessary with this new feature. Simply put the starter in place . . . . and the stabs automatically engage the bus bars in quick, positive connec-

SAVES SPACE This compact centralized motor control system permits you to put all of your control in one spot—simplifies installation, interconnections, and maintenance. Control centers are only 12 inches deep, all wiring is front-connected so units may be placed back to back, in an "L" shape or flush against the wall.

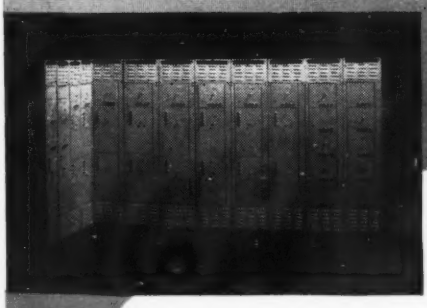
INTERCHANGEABLE

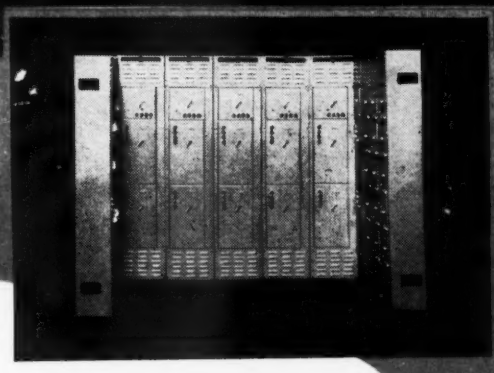
All vertical sections are the same size, all starter units are proportionate. No special engineering is necessary to plan your own G-E control center. To make it even simpler—starter units for motors from 1 to 25 horsepower have the same overall dimensions.

GENERAL ELECTRIC

676-263

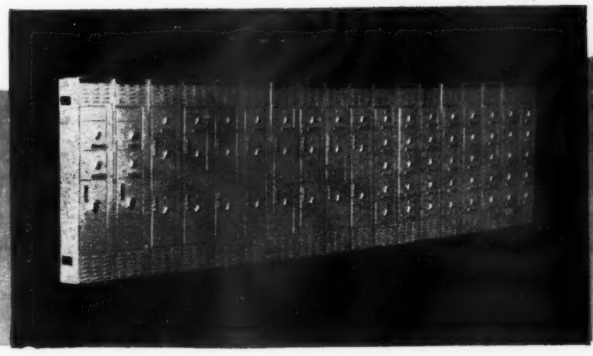
tion. For emergency handling, the starter can be removed without de-energizing the power bus after a simple removal of the supporting bolts.





PLAN YOUR OWN G-E MOTOR CONTROL CENTER

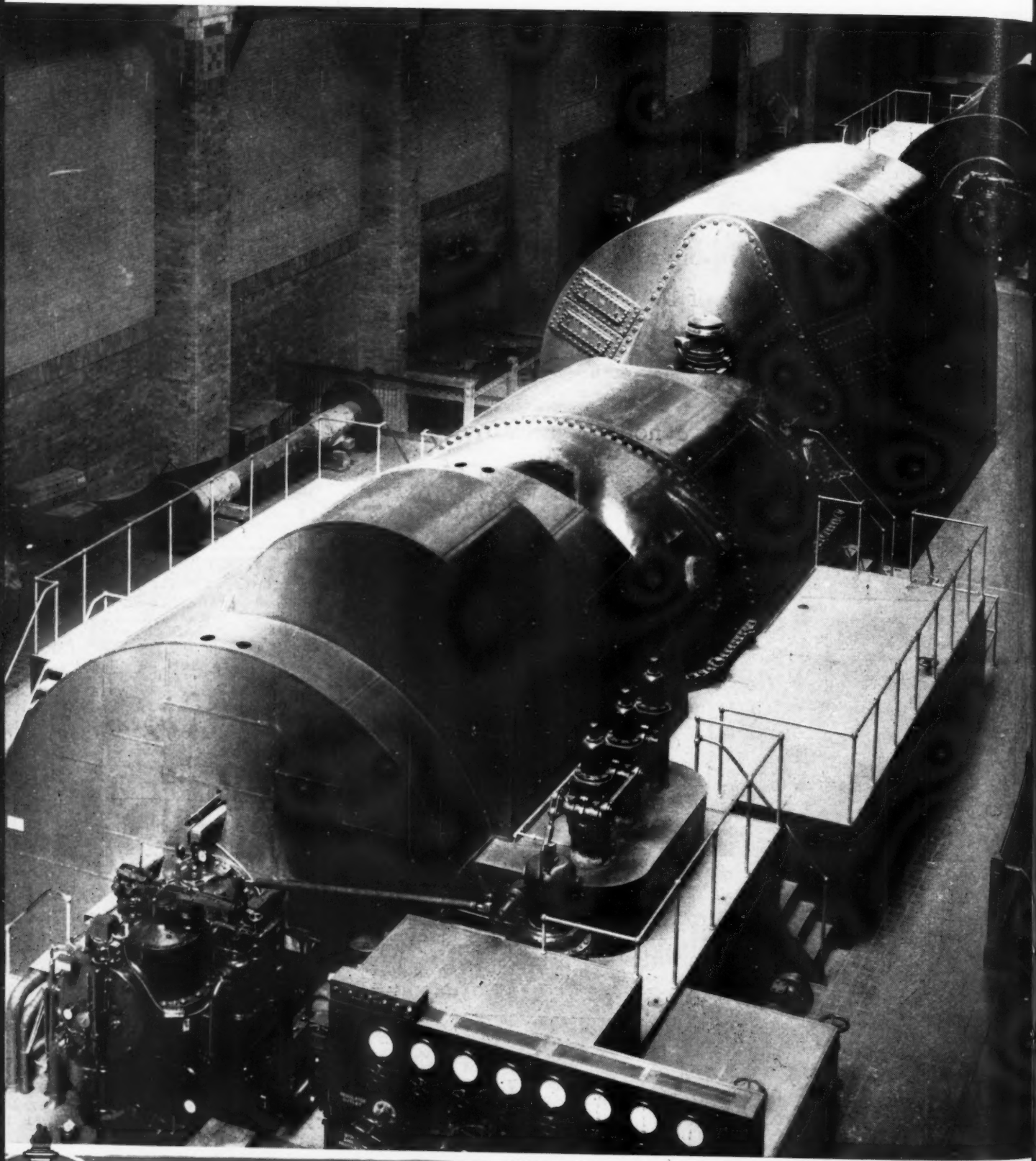
Contact our sales engineer at the nearest G-E office for copies of an easy-to-use planning chart—or write us for bulletin GEA-4979 which contains additional information. ***Apparatus Dept., Section 676-263, General Electric Company, Schenectady, New York.***



P.S.

TO METHODS MEN, ELECTRICAL CONTRACTORS, CONSULTANTS: Have you thoroughly investigated the many applications of low-cost baking, drying and heating with clean, efficient infrared lamps? See G.E.'s MORE POWER TO AMERICA program on the application of infrared in manufacturing. The color slidefilm shows many applications and suggests others; a technical manual supplements the film. Ask your electric utility or G-E representative today for a showing.

160,000 KW... safeguarded agains



STANDARD OIL COMPANY (INDIANA)

outages by

NONPAREIL Turbine Oil

The two big turbines shown in the photograph at left have a total capacity of 160,000 KW. Outages for oil system maintenance have been eliminated on this large operation by Nonpareil Turbine Oil.

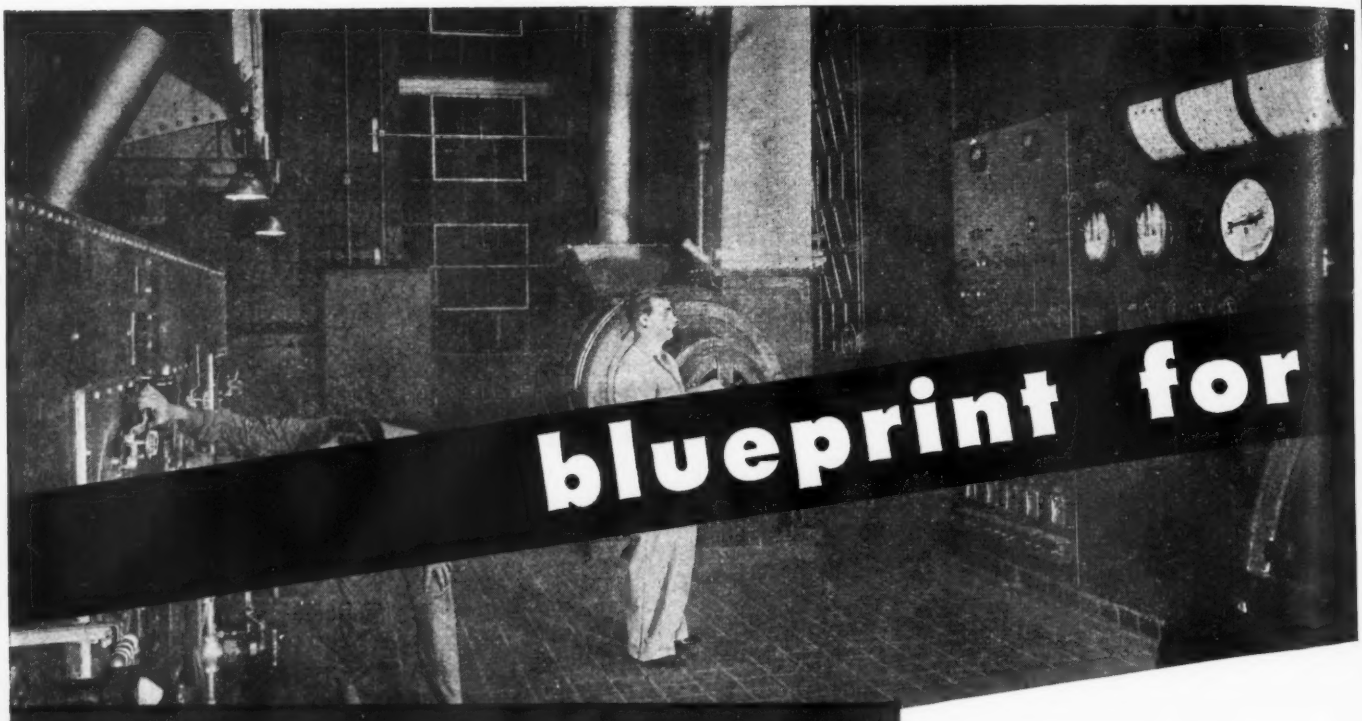
Oil acidity troubles have been avoided. The original fills of Nonpareil have not been removed for treating or resting in their respective five and six years of use. Nevertheless, neutralization numbers have stayed below 0.10 mg. KOH/gm.

Oil system maintenance has been eliminated. There has been no deterioration of the lubricant. The turbine oil systems have remained free from deposits.

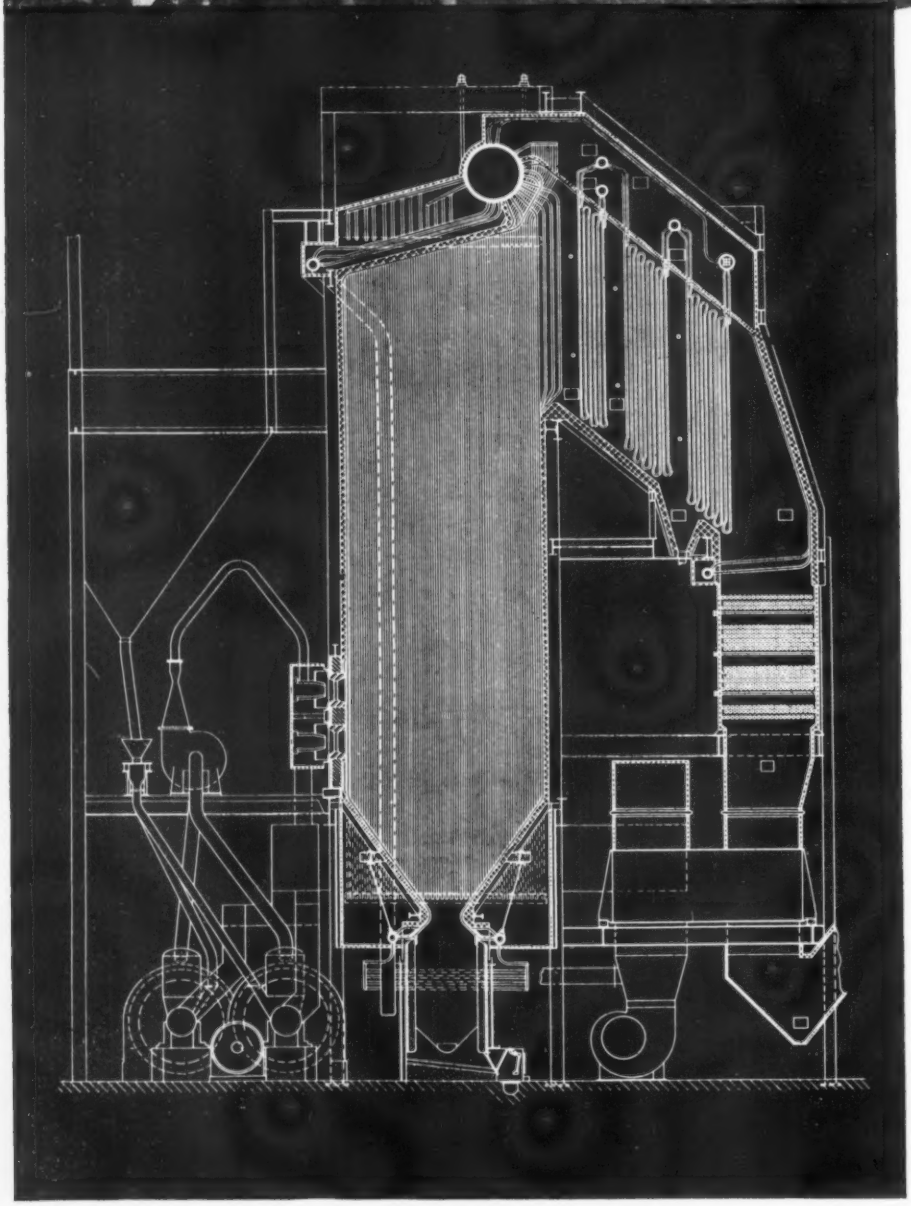
Nonpareil Turbine Oil provides this protection against outages, not for 5 or 10 or 20 years, but for the life of every turbine it lubricates. It is the only product in its field that carries a written guarantee that it will last as long as your turbine, without increasing in acidity above a neutralization number of 0.15 mg. KOH/gm.

Why not end oil acidity troubles and oil maintenance once and for all, by shifting your turbines to Nonpareil Turbine Oil. If your plant is located in the Midwest, write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the services of the Standard Oil Lubrication Engineer nearest you.

STANDARD OIL COMPANY (INDIANA) STANDARD



blueprint for



E. M. POSTON STATION
COLUMBUS AND SOUTHERN OHIO ELECTRIC COMPANY

Steam Capacity
425,000 lb per hr

Superheat control range
300,000 to 425,000 lb per hr

Pressure superheater outlet
1354 psi

Final steam temperature
955 F

Bituminous Coal Pulverized
in FW Ball Mills

Standardized Steam Generating Equipment for Central Stations

Foster Wheeler has demonstrated outstanding leadership in developing central station equipment which helped the Utility Industry to achieve increased productivity. A large share of the credit can be directly ascribed to the FW line of single-pass, baffle-less steam generators having liberal furnace dimensions. This arrangement has been used as the basis for "Preferred Standard" steam generator designs which have been developed by Foster Wheeler Corporation for the Utility Industry.

Engineering and Manufacturing Costs Reduced

The "Preferred Standard" steam generator design (suggested on the right) promises substantial savings by the reduction of engineering and fabrication costs.

Fixed Individual Equipment Details

The unit being built for the E. M. Poston Station of the Columbus and Southern Ohio Electric Company is typical of the single-pass design which Foster Wheeler is using as the basis for "Preferred Standard" steam generators. This standardized steam generator pattern with fixed individual equipment details may be readily applied to a series of single or twin furnace units varying in capacity from 300,000 lb per hr to over 1,000,000 lb per hr.

Other Foster Wheeler Fuel and Labor Saving Features

The design also embodies Foster Wheeler features of slag-free furnace arrangement, Foster Wheeler condenser-type steam temperature control, minimum baffles, low draft loss, and efficient heat recovery arrangement. When additional furnace cooling is required, the "Preferred Standard" design may readily incorporate a water cooled division wall.

For additional information, write . . .

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

A *New* YARWAY AID TO . . .

BETTER POWER

HI-LO-GRAPH LIQUID LEVEL RECORDER

ermanent, hour-by-hour records of boiler water levels n be charted with the new Yarway Hi-Lo-Graph.

he Hi-Lo-Graph not only *records* . . . it also *indicates* oiler water level changes. Brightly lighted active section the chart makes pen arm clearly visible as indicator.

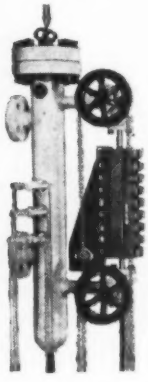
dication is *instant* and *accurate* because the Hi-Lo-raph is operated by the boiler water itself. No stuffing xes. Actuating mechanism is never under pressure.

Easily installed on new or existing boilers. Designed for wall or panel mountings. For all pressures up to 2500 psi.

For complete description, write for new Yarway Bulletin WG-1830.

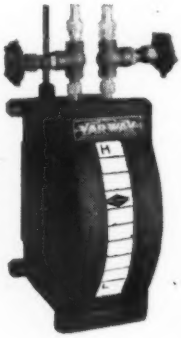
YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

OTHER YARWAY LIQUID LEVEL INDICATING EQUIPMENT



WATER COLUMNS AND GAGES

Yarway columns feature the *floatless* Hi-Lo-Alarm Signal. Two types of gages—Sesure Inclined and Vertical Flat Glass. Write for Catalog WG-1811.



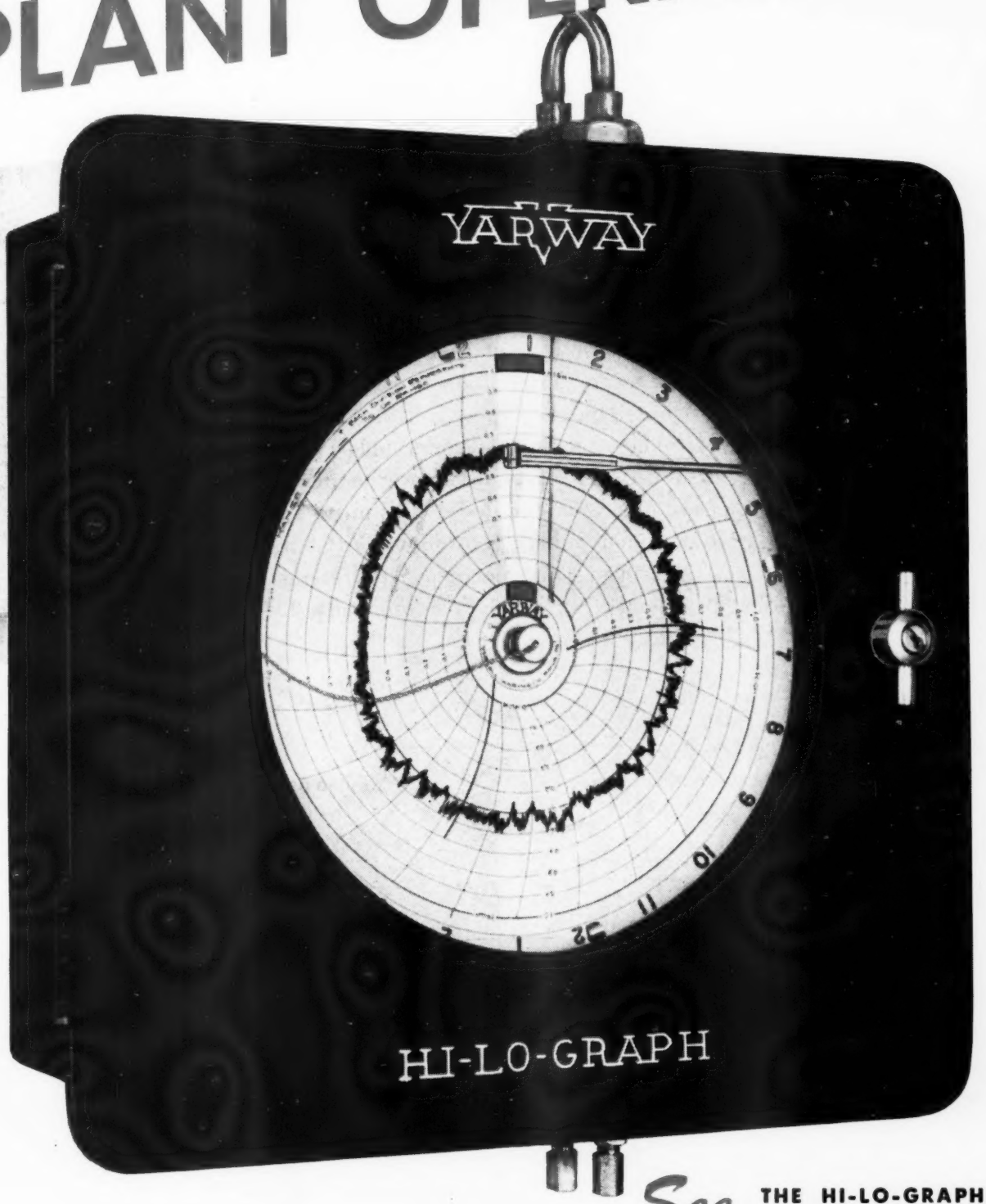
REMOTE LIQUID LEVEL INDICATOR

Brings overhead gage readings right down to eye level—on instrument panel or other convenient place. *Instant, accurate* indication. Completely described in Catalog WG-1822.

REMOTE HORN AND LIGHT SIGNAL ALARMS

Operated anywhere in power plant by Control Unit located on YarwayRemote Liquid Level Indicator. Completely described in Catalog WG-1822.

PLANT OPERATION

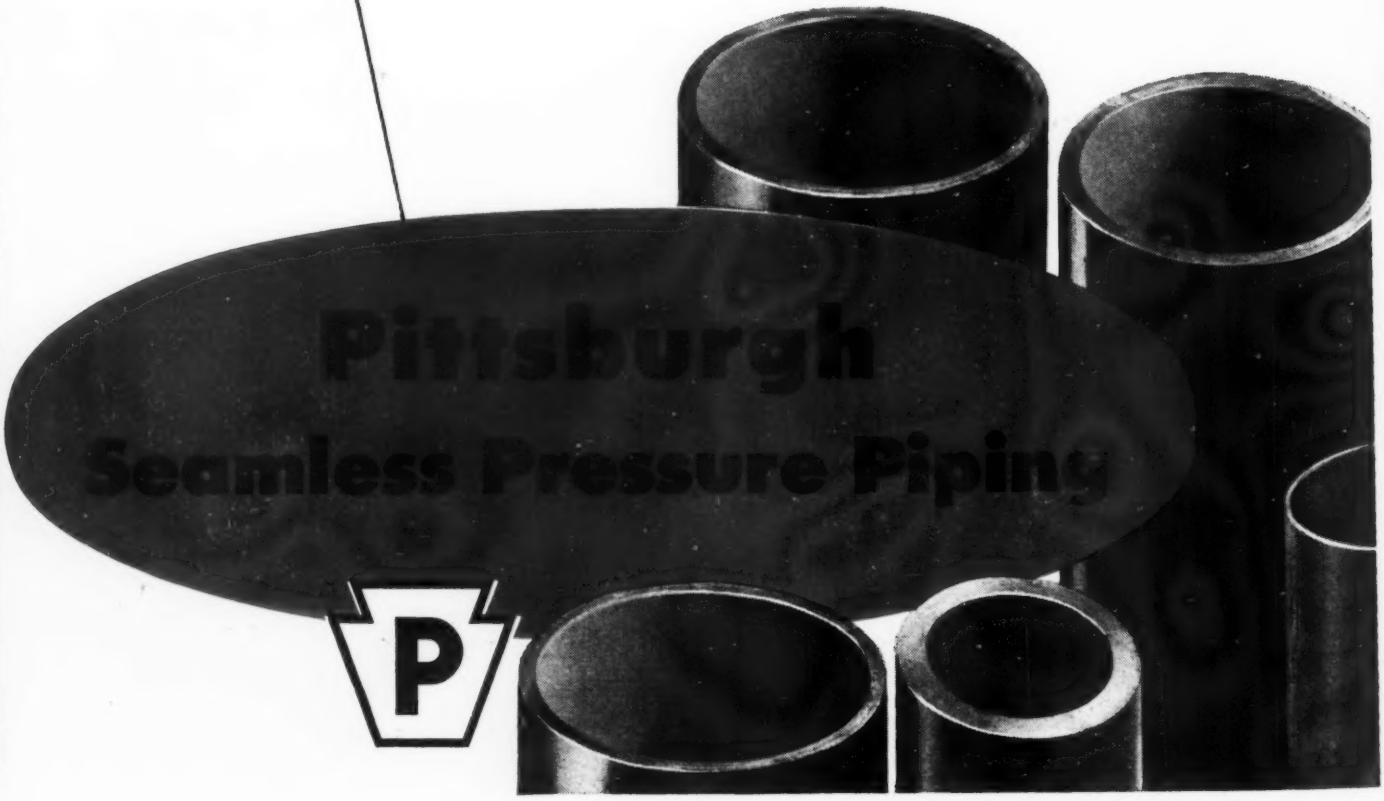


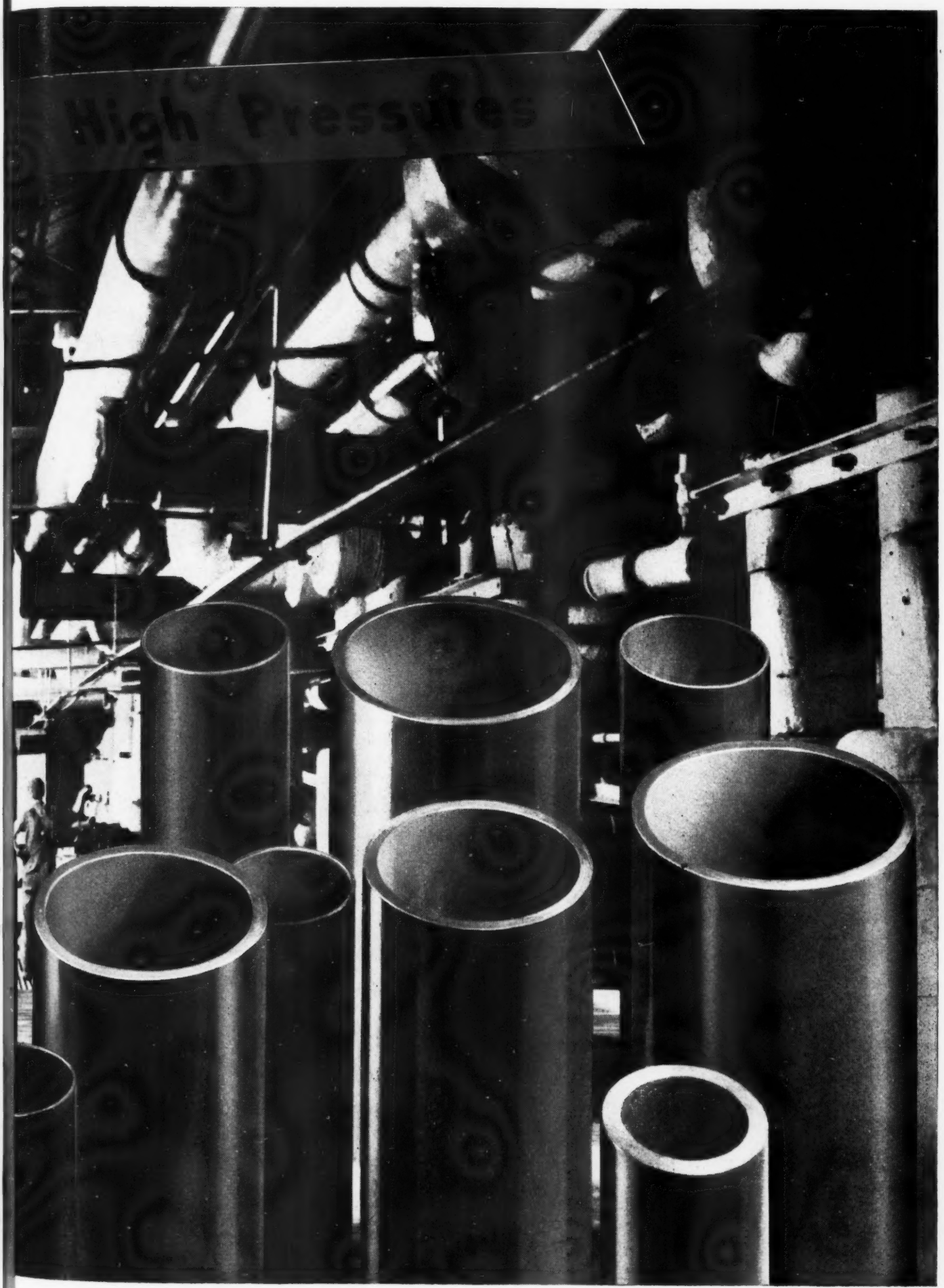
See THE HI-LO-GRAPH AND OTHER YARWAY EQUIPMENT AT THE NATIONAL POWER SHOW, NEW YORK, NOV. 29 TO DEC. 4 — BOOTHS 65 AND 66

YARWAY **POWER PLANT EQUIPMENT**

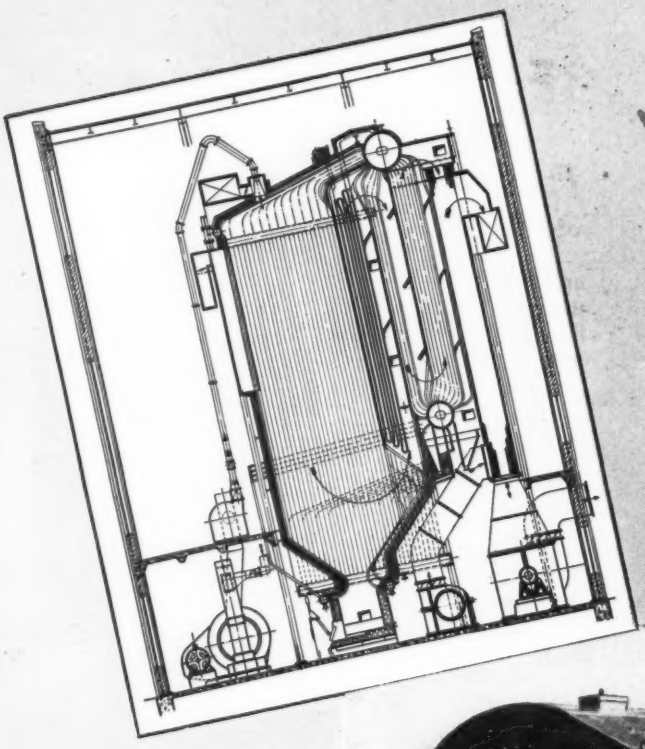
For High Strength at

Pittsburgh Seamless Power Piping has the tensile strength to give you long trouble-free service under normal or forced service because it is made by men who specialize in high quality tubes. In addition to having the proper strength, Pittsburgh Power Piping has the ductility to afford ease of coiling, bending, flanging, and expanding when being installed. It is produced in carbon, carbon-molybdenum and other alloy grades in sizes up to and including 12". Like many others, you will find Pittsburgh Power Piping gives you safe, economical operations under all conditions. Pittsburgh Steel Company, 3270 Grant Building, Pittsburgh 30, Pa.




High Pressures

KVS Engineered..



KVS

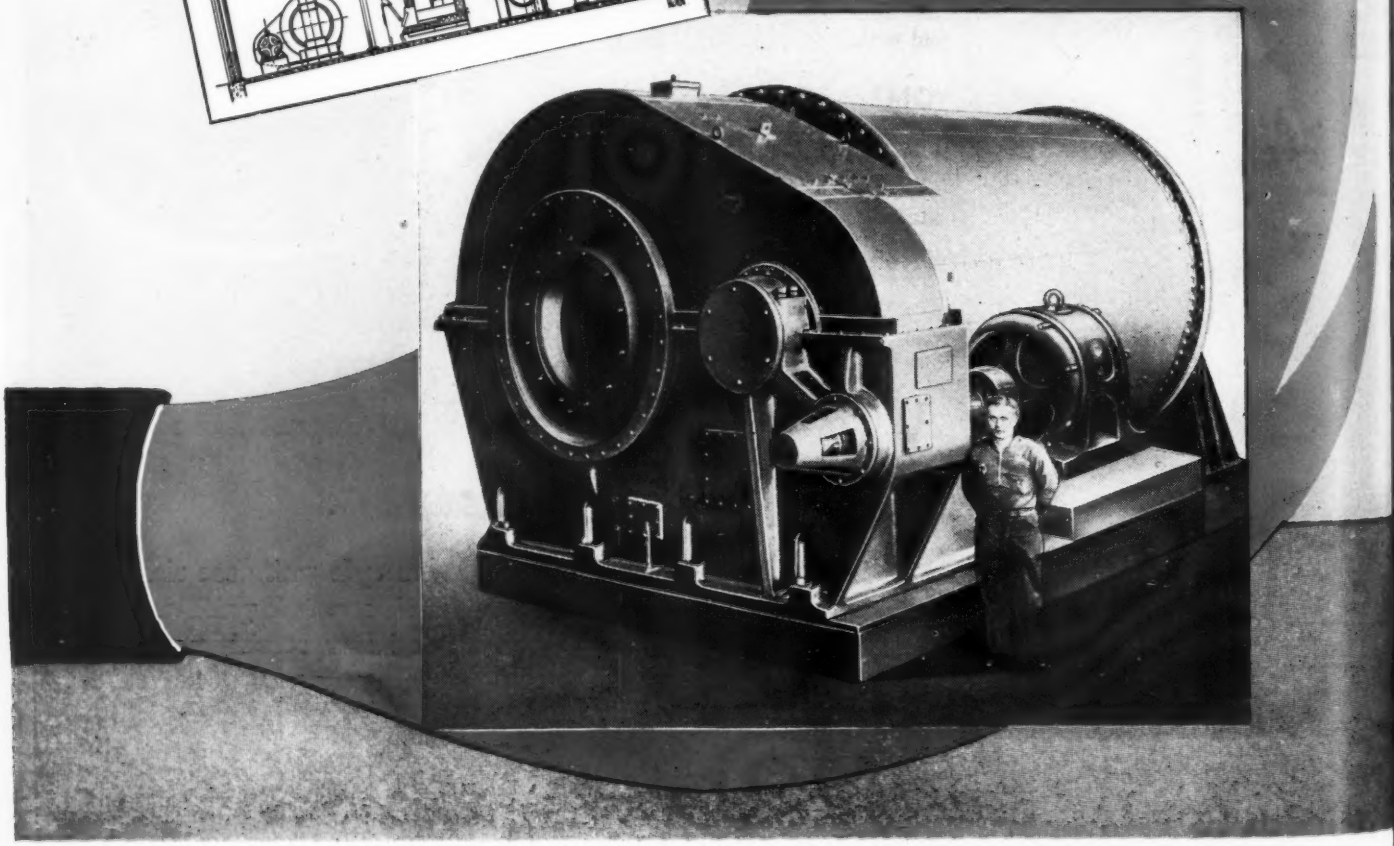
COMBUSTION EQUIPMENT

FEEDER • AIR SWEPT TUBE MILL

MILL LEVEL CONTROL (Electronic)

CLASSIFIER • EXHAUSTER

BURNERS



Pulverization

Less than ½% Unburned Carbon
with
KVS AIR SWEPT TUBE MILLS

A Completely Carbureted Fuel

Floating out an impalpable powder to the burners, the Kennedy Van Saun Tube Mill gets the last half-cent from your coal dollar. Unburned carbon amounts to less than ½%. In a KVS-engineered pulverizing and firing unit, the variable speed KVS exhauster draws preheated air through the mill inlet, the air stream picks up the fines and drops out coarse particles to the built-in classifier so that coal-powder at the burners will regularly test *85% to 95% through 200 mesh.*

As everyday proof that an instantly-combustible combination of oxygen and carbon is delivered to the KVS pulverized coal burners, cold units are safely lighted-off with the simplest torch. No other equipment is needed.

WET COAL

Direct firing of open-stored coal is standard practice. Hot air separates moisture from each coal particle during passage through the mill to the burners. The temperature of the air leaving the mill is controlled so there is no danger of preignition. "Black mud", fissured by rain gullies, directly from the storage pile to the KVS Air Swept Tube Mill, is now being burned without the use of a dryer.

TRAMP IRON? LEAVE IT IN!

The KVS Air Swept Tube Mill is a slow-speed machine cascading Herculite steel balls against Herculite liners to pulverize hard or soft coals. Tramp iron contributes to the pulverizing effect. Replacement grinding balls are fed through the coal inlet at regular mill speed. There is no shutdown for ball classification.

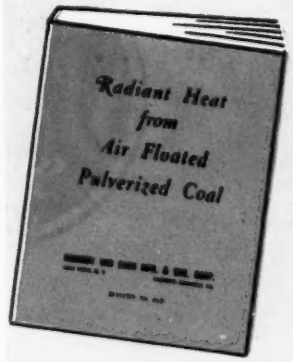
Provide coal . . . any coal . . . and specify KVS pulverizing and firing equipment. A superfine fuel . . . in quantities from 1200 pounds to 35 tons per hour . . . with complete control of firing rate . . . is now at your command.

●

All other components of KVS Steam Generating Units are engineered to meet specific operating conditions on available fuels in order to assure the maximum in operating efficiency and economy at all boiler ratings.

KVS ENGINEERING SERVICE

KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultations on your requirements.



Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

KENNEDY-VAN SAUN · QUALITY · Kennedy Products · NEW YORK USA · SERVICE · MFG. & ENG. CORP.

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION
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FACTORIES: DANVILLE, PA.
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ARMY E NAVY

You have known this nameplate for 30 years

Now—get acquainted with this one

For nearly a generation the Hagan name on a control panel has been the mark of *dependability*—of a combustion control system that is simple, rugged, accurate, functioning day after day and year after year with a minimum of maintenance.

The same characteristics of simplicity, ruggedness and accuracy, with their resulting *dependability and low maintenance* are found in Hagan Ring Balance Flow Meters.

Our engineers will be glad to show the advantages of Hagan control and Hagan metering in your plant.

Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

HAGAN
HALL
BUROMIN
CALGON

HAGAN CONTROL

RING BALANCE

HAGAN
CORPORATION
PITTSBURGH, PA.
Ring Balance
INSTRUMENTS

HAGAN CORPORATION

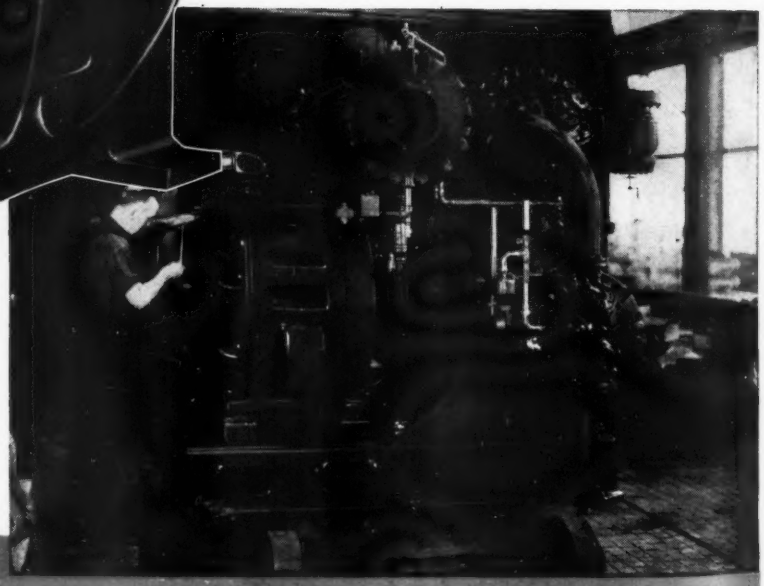
HAGAN BUILDING, PITTSBURGH 30, PA.

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

they're here... they're

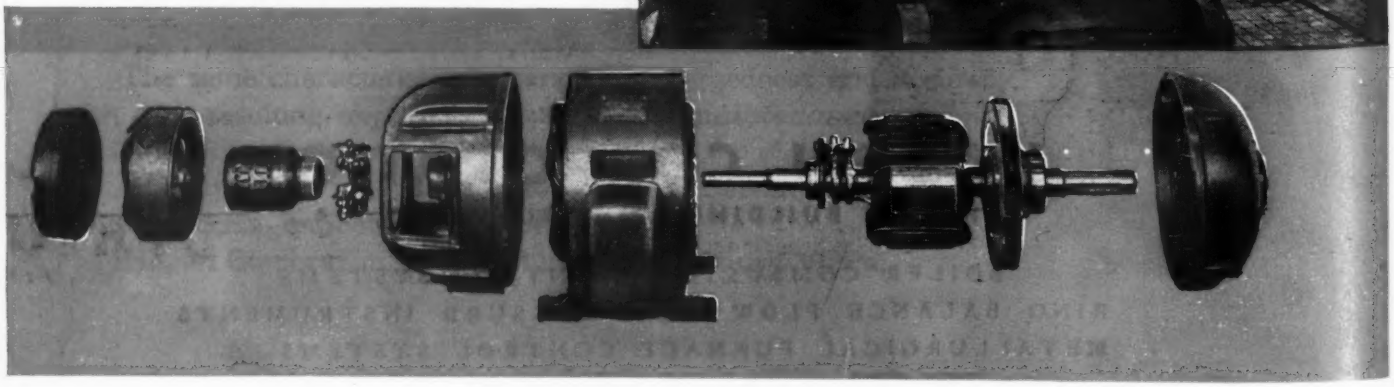
NEW HIGH

A new TRI-CLAD Synchronous Motor typical of those machines rated at about 500 hp at 720 rpm.



A new TRI-CLAD High Speed Synchronous Motor, rated 250 hp at 600 rpm, direct coupled to an air compressor.

Exploded view of G-E TRI-CLAD machine.



TRI-CLAD

REG. U.S. PAT. OFF.

SPEED SYNCHRONOUS MOTORS AND GENERATORS

These new synchronous motors and generators bring you the famous TRI-CLAD improvements:

Extra Protection Features!—against physical damage—against electrical breakdown—against operating wear and tear.

New Styling!—smooth, rounded contours—baffled ventilating louvers—smooth-corners on exciters and conduit boxes.

Following General Electric design leadership, the new line of Tri-Clad synchronous motors and generators give you the same design features that made Tri-Clad motors so successful in more than a million and a half industrial applications.

Tri-Clad construction gives you protection where it counts. Frames and end shields with no openings above the center line—give protection against dripping liquids, falling objects, and accidental blows.

You get protection against electrical breakdown in normal operations. Proved insulating materials of the highest quality are used throughout. Small sizes (through frame 945) use Formex* wire for low voltage windings. Larger size coils are form wound and molded accurately to slot size.

Bearings are completely enclosed in cast iron with close running fits for long life with minimum maintenance. Deep oil reservoirs insure adequate lubrication with clean, cool oil.

You can get synchronous motors in the new Tri-Clad design in ratings from 20 hp to 1000 hp at 60 cycles, speeds from 514 to 1800 rpm. Synchronous generators are available from 12½ to 1250 kva. Direct connected exciters are available for any rating.

About ten years ago, the Tri-Clad design was introduced to combine the important features demanded by industry. Since then, it has been further improved with additional refinements—all of which have been incorporated in this new line of synchronous motors and generators.

For more information on how you will benefit from Tri-Clad construction in your synchronous motor and generator installations, contact your nearest G-E sales engineer. For detailed construction features, write for GEA-5113 (Motors) or GEA-5125 (Generators). *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

*Reg. U. S. Pat Off.

Typical TRI-CLAD High Speed Generator with direct-connected exciter.

GENERAL ELECTRIC

770-1

....."LIKE HAVING THREE

LUNKENHEIMER 150 lb. S.P.

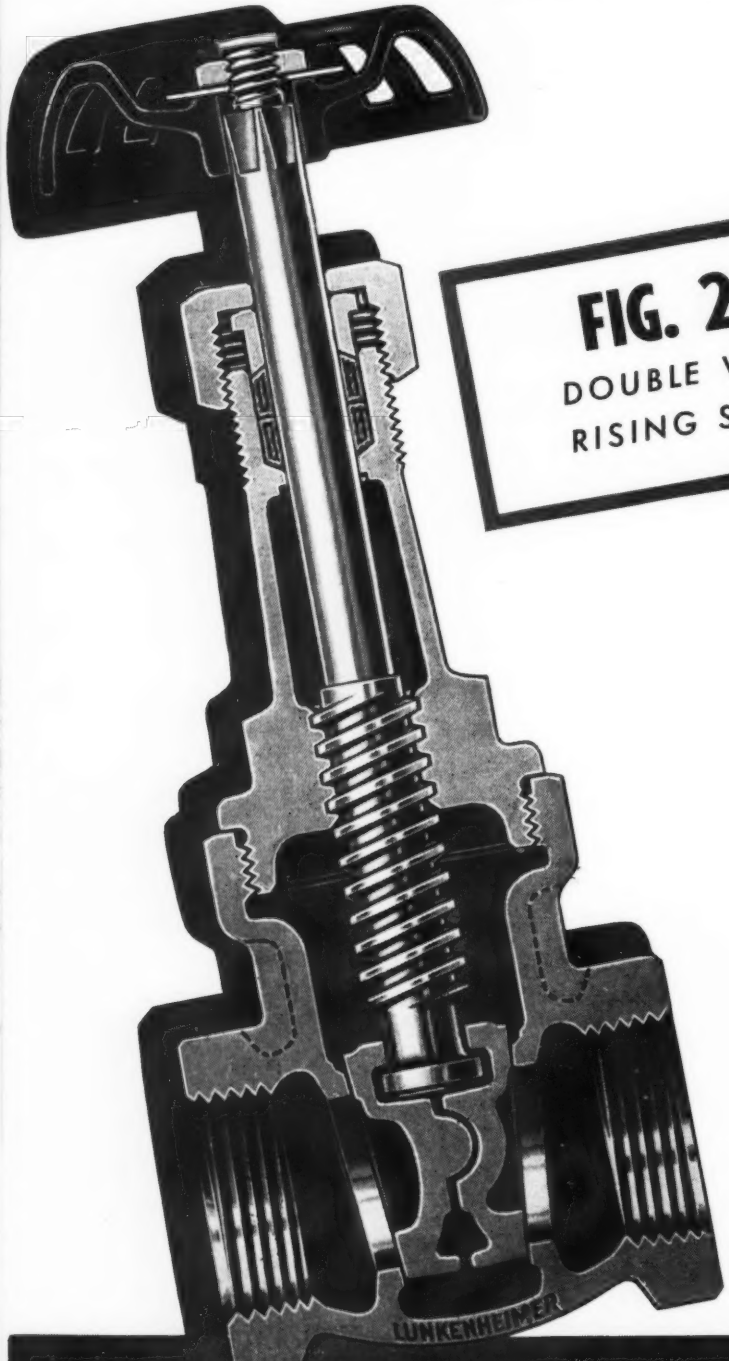


FIG. 2150
DOUBLE WEDGE DISC
RISING STEM

PHONE YOUR DISTRIBUTOR

Design, construction and interchangeability are fully illustrated and described in Circular 574. Ask your distributor for a copy or write us direct.

See Our Exhibit at the 18th National Exposition of Power and Mechanical Engineering. *Booth #52, Grand Central Palace, New York. November 29th - December 4th.*

LUNKENHEIMER VALVES

VALVES IN ONE"

BRONZE GATE VALVES

THE enthusiasm of maintenance men *and* engineers for the Lunkenheimer new 150 lb. Bronze Gate Valves is understandable. Actually, a simple interchange of trimmings provides, from minimum stocks, a valve for every spot where a 150 lb. Bronze Gate Valve is needed.

Ruggedly designed throughout, each valve features the Lunkenheimer developed and patented wear-resistant alloy stem material which eliminates failures due to stem thread wear.

Whether you have one . . . or thousands of 150 lb. bronze gate valves in your plant, you'll find definite advantages in the LUNKENHEIMER Fig. 2150 line of 150 lb. gate valves.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

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NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 34

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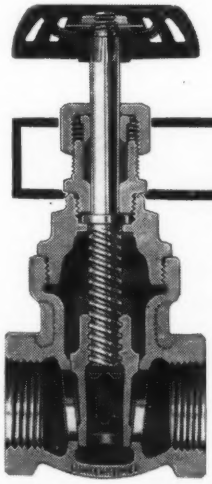


FIG. 2153

Embodies all the features in Figs. 2150 and 2151, but its design is varied to provide non-rising stem operation. Body is the same thus requiring only an interchange of trimmings, to convert from the non-rising stem to the rising stem valve.

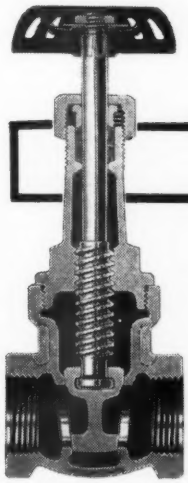


FIG. 2151

SOLID WEDGE DISC. The solid disc is ideal for services such as food processing lines and handling gummy substances, where entrapment of line materials within the disc is undesirable.

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S. P.; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

No Other Water Conditioning System Has All of These Features...

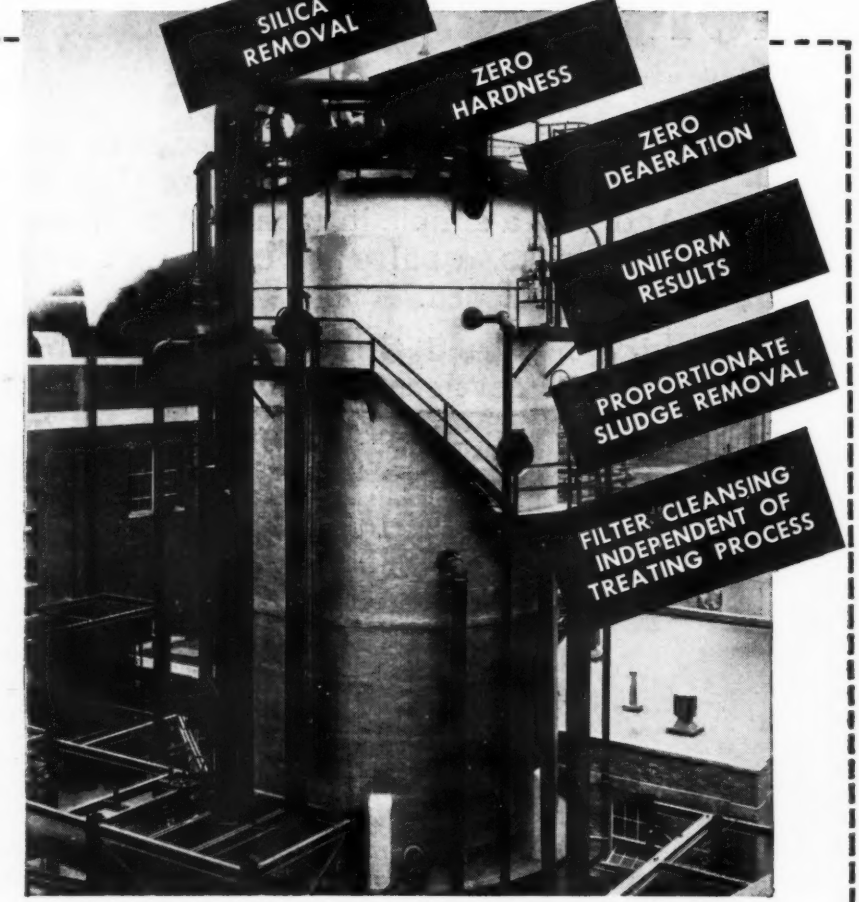
...ALL IN ONE TANK:

YES, you get all these and more, too, in one tank without the aid of internal mechanical agitation or other moving parts when a water conditioner like this 900,000 lb. per hour Worthington installation treats your make-up or condensate water.

In less space you get all the heating, chemical feeding and clarification facilities to provide optimum water conditioning results. Worthington's engineering skill and complete manufacturing facilities offer you the advantages which can only result from carefully coordinated effort under one responsibility.

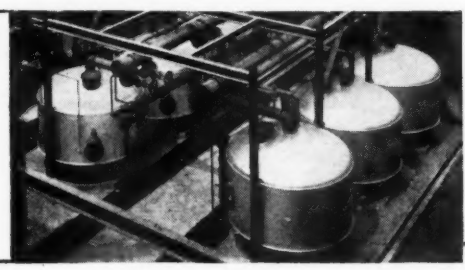
WRITE FOR FACTS

For proof that, in water conditioning as in so many other services, *there's more worth in Worthington*, write for Bulletin W-212-B2. *Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, N.J.*



Main treating tank of a Worthington Hot Process Water Conditioning System, capacity 900,000 lb. of treated water per hour

Six pressure filters 11 feet in diameter used for final clarification in this Worthington Hot Process Water Conditioning System



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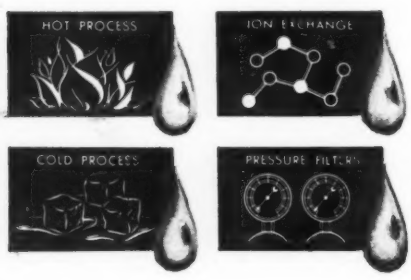


WORTHINGTON

WATER CONDITIONING

Worthington Makes More *of the Equipment For All Types of Water Conditioning Systems*

ALLIS-CHALMERS "Certified" Service

A BREAKDOWN on this 39-year-old Allis-Chalmers fan motor crippled operations at the plant of an important midwest electric utility. Immediate repair was vital. The Chief Engineer called the nearest Allis-Chalmers Certified Service shop. They picked up the rotor and returned it ready for service in less than twenty-four hours.

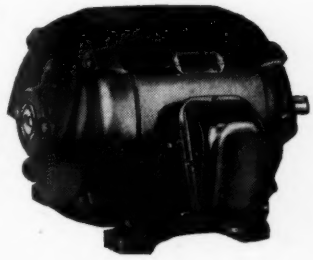
This is the kind of emergency cooperation you can expect from every Allis-Chalmers Certified Service shop. On everyday repairs and maintenance too, your Allis-Chalmers Certified Service shop will give you prompt service on Allis-Chalmers motors, pumps and transformers, using factory approved methods and parts. Every Allis-Chalmers Certified Service shop has been selected for skilled, personal, careful workmanship, adequate equipment and *service mindedness.*

HOW TO FIND NEAREST SERVICE SHOP

Allis-Chalmers Certified Service shops are located in major industrial centers throughout the country. New shops are being appointed continuously and most smaller centers will soon be covered. To find the shop nearest you, call your closest Allis-Chalmers District Office. A 2543

MOTOR DELIVERIES GREATLY IMPROVED

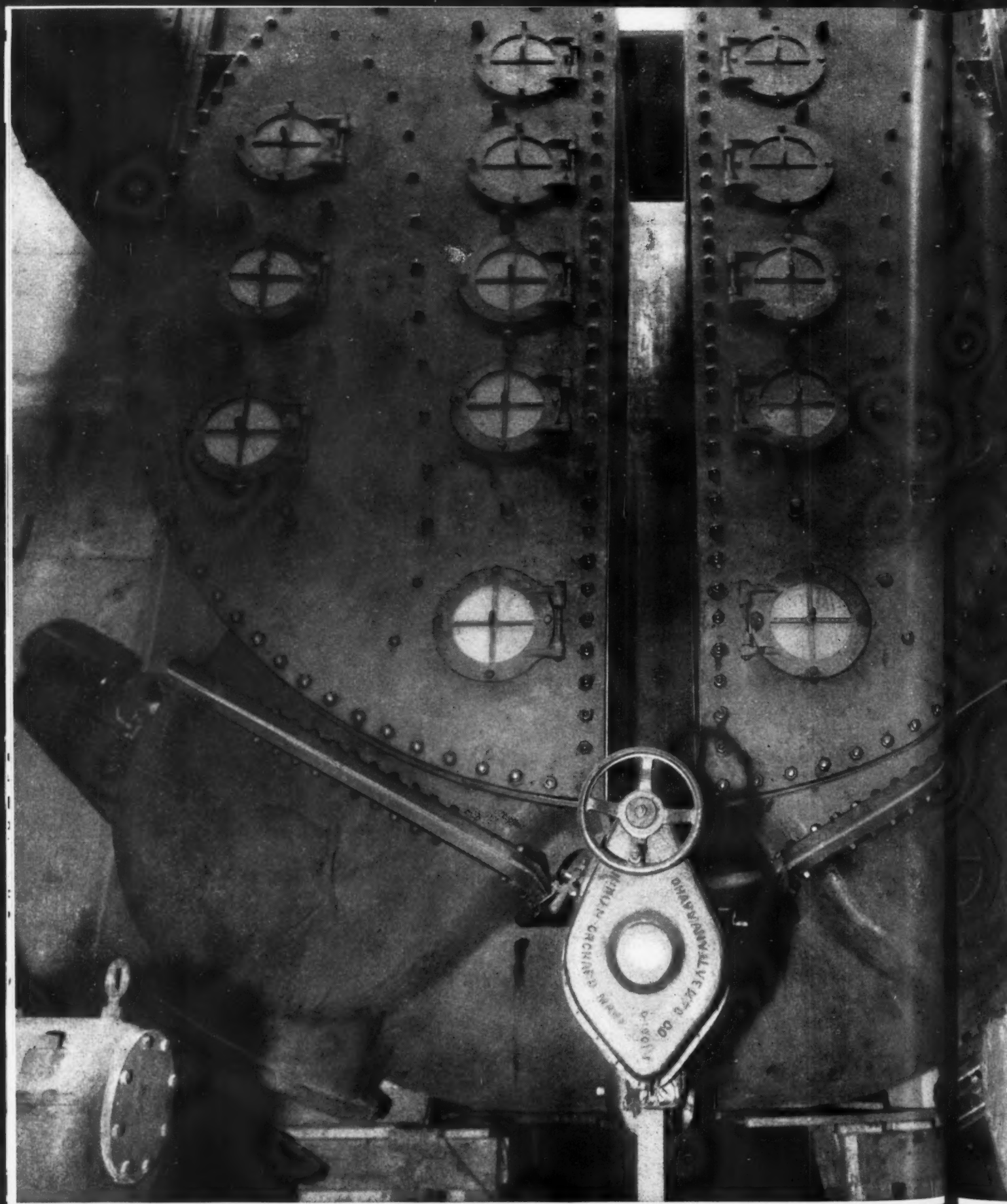
Many types of Allis-Chalmers Motors are now in stock! Many other types are available on short delivery! For motors from 1 to 200 HP, check your nearest Allis-Chalmers Authorized Dealer. For motors larger than 200 HP, check with the nearest District Office. You may be able to get what you need sooner than you think.



ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment from Generation through Utilization



C. H. Wheeler

50,000 Sq. Ft., 2 Pass Reverse Flow Condenser

Under 60,000 K. W. Steam Turbine

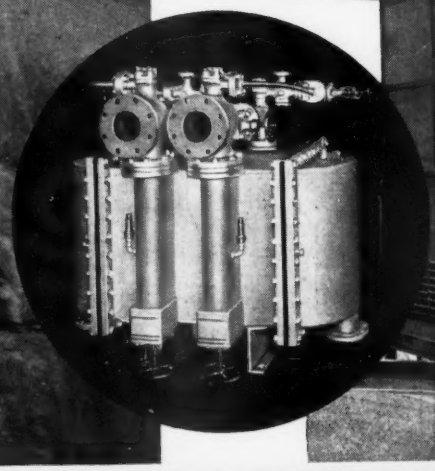
A certain large public utility (name on request) faced the problem of leaves, trash and other refuse in their only available supply of condenser circulating water. They could have installed a standard condenser, but they found many advantages, including money saving, in selecting a C. H. Wheeler Patented "Reverse Flow" Condenser. Periodic reversal of water flow automatically cleans the tubes and tube sheets of this condenser, without loss in efficiency. Installation was simplified with the C. H. Wheeler "Reverse Flow" because it does not require any additional piping over that of a standard condenser. Photo shows this installation nearly completed. Note the two C. H. Wheeler Circulating Pumps which partly show in the foreground; also the Cross Over Valve for operation with one circulating pump. Condenser is equipped with C. H. Wheeler Steam Jet Ejectors and C. H. Wheeler Condensate Pumps. Write for more information about "Reverse Flow" or Standard "Dual Bank" Condensers, described in Catalog No. 1461.

C. H. WHEELER MANUFACTURING CO.

1800 Sedgley Avenue, Philadelphia 32, Penna.

REPRESENTATIVES IN MOST PRINCIPAL CITIES

Right—C. H. Wheeler Induced Draft Water Cooling Tower built with steel casing, as illustrated, or entirely of redwood. Circle—Tubejet Steam Jet Ejector for power plant service; also one to five stage units for process application. Catalogs on request.



TEAM CONDENSERS • WATER COOLING TOWERS
JECTORS • STEAM JET VACUUM REFRIGERATION
F PHILADELPHIA

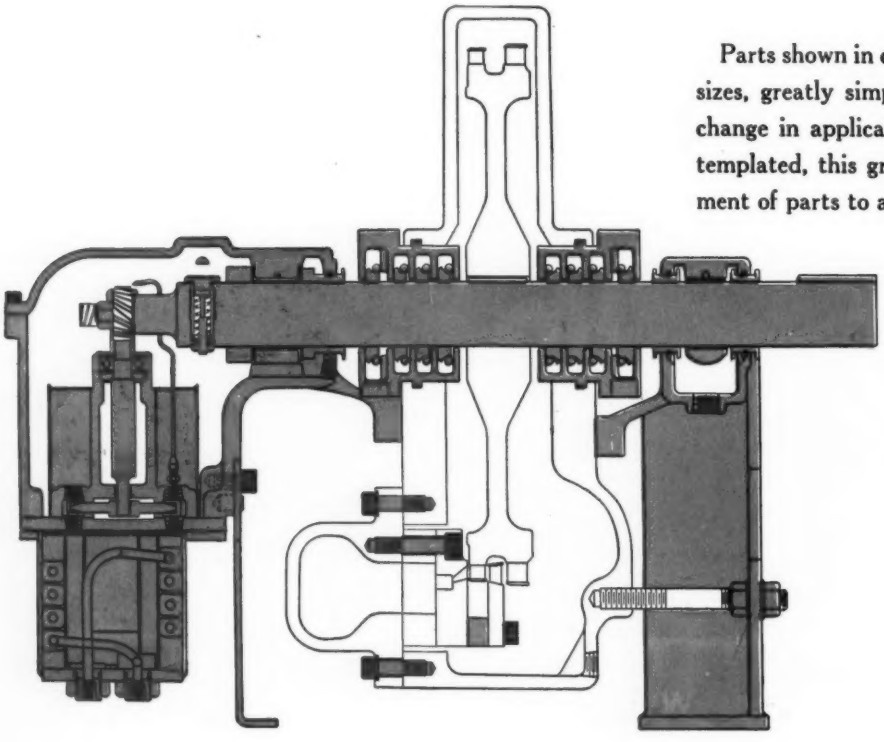
FOR LOWER COST SPARE PARTS...

This set of packaged spare parts for the new Type DP turbine line costs you less than 25% of the price of a comparable set of spares for previous G-E small turbines. Greater standardization and improved design make this saving possible.

Best of all is the fact that parts in this standard kit are applicable to *all* Type DP turbines, whether 10 or 1000 hp. This permits you to cut your spare parts inventory drastically, at the same time provide better insurance against shutdowns.

STANDARDIZE

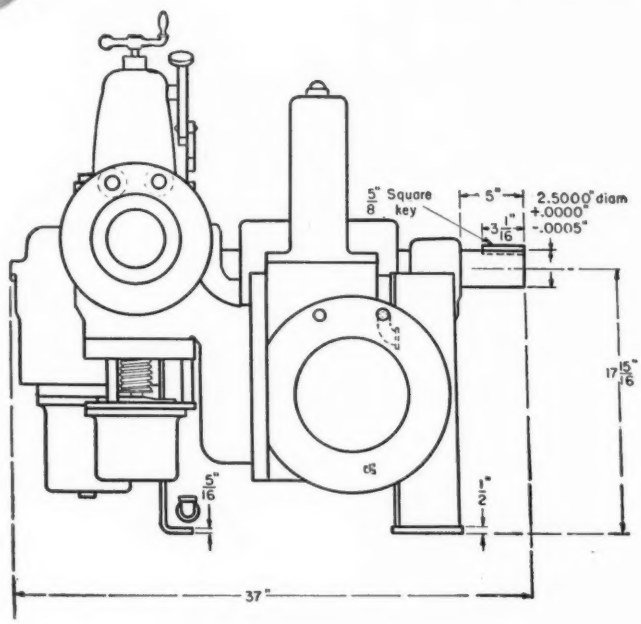
FOR INTERCHANGEABILITY...



Parts shown in color are interchangeable on all frame sizes, greatly simplifying maintenance. Also, where a change in application or rating of a turbine is contemplated, this greater standardization keeps replacement of parts to a minimum.

ON THE NEW STANDARD TURBINES

FOR SIMPLER INSTALLATION...



Dimensions shown are common to all frame sizes. For instance, shaft height is the same on all DP units, permitting you to use a standard mounting height on all your turbine drives. Also, all DP shafts are identical, permitting you to use standard couplings.

When it comes to alignment, you'll appreciate the DP's center-line support—now standardized on all frame sizes. Center-line support eliminates misalignment resulting from expansion from normal heating. Once installed, the DP stays in proper alignment—hot or cold.

The greater standardization of the new Type DP line permits us to offer a host of superior design features—all at no extra cost. Price level of the DP line is the same as that of the previous DS line.

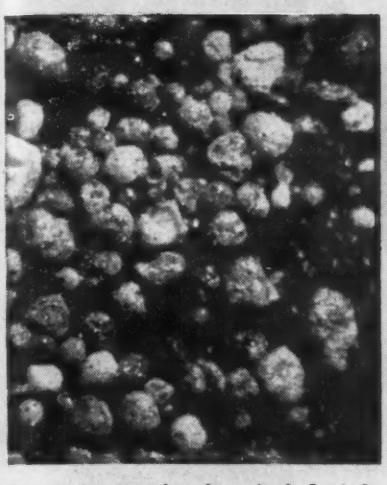
For the full story of how these features can mean operating benefits to you, call your G-E representative. Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

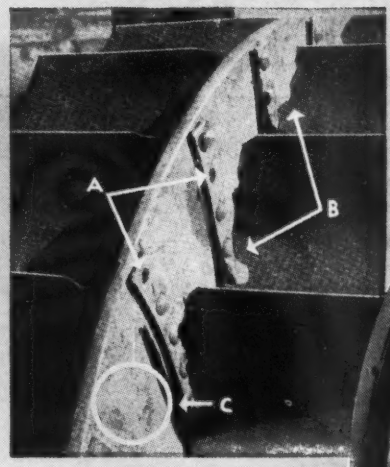
252-30

NO OTHER INDUCED DRAFT FAN FIGHTS FLY-ASH LIKE THE STURTEVANT E-R WHEEL

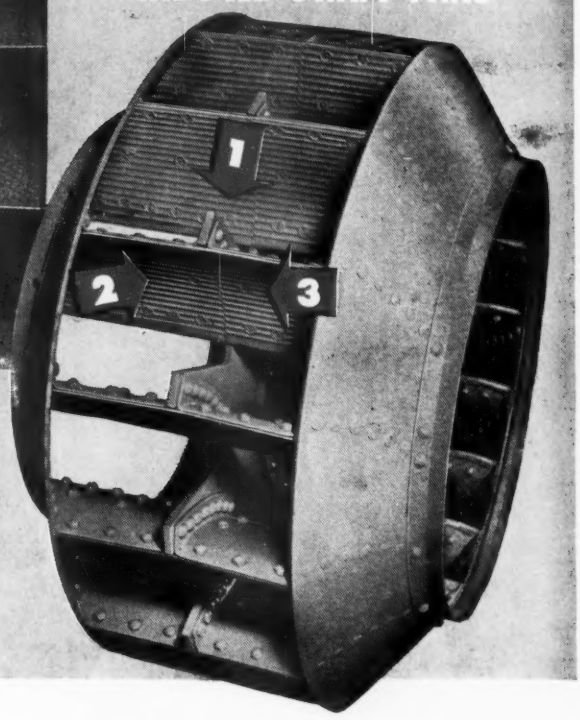
FLY ASH ... WHAT IT CAN DO ... HOW TO COMBAT IT WITH Sturtevant INDUCED DRAFT FANS



Photomicrograph of typical fly-ash resulting from the burning of pulverized fuel in a modern power plant. Fly-ash produced by stoker coal is similar in appearance. Both types of fly-ash can cause a great deal of damage to fan wheels—as shown in picture on the right.



Photograph of a typical fan wheel sent to the Sturtevant Division Research Department for study after erosion had ended its usefulness. Note the missing rivets at A, which were cut out by fly-ash. B shows erosion of blades at center plate, and C, erosion of the center plate proper.



1 Streams of concentrated fly-ash meet—and dissipate their abrasive action on each other instead of on the wheel surfaces. That's possible because the center support of the E-R wheel is cut away between the fan and the blades.

2 Smooth flow of fly-ash is assured with continuous blades offering no obstruction. Center plates and tie rods are eliminated. Each wheel has only 16 blades, shaped to minimize abrasive action.

3 Special ribbed liners protect the wheel blades. When liner wear is concentrated, life can be extended by welding locally. These liners, which are easily and quickly renewable, prolong wheel life, save maintenance time and labor, and minimize outage losses.

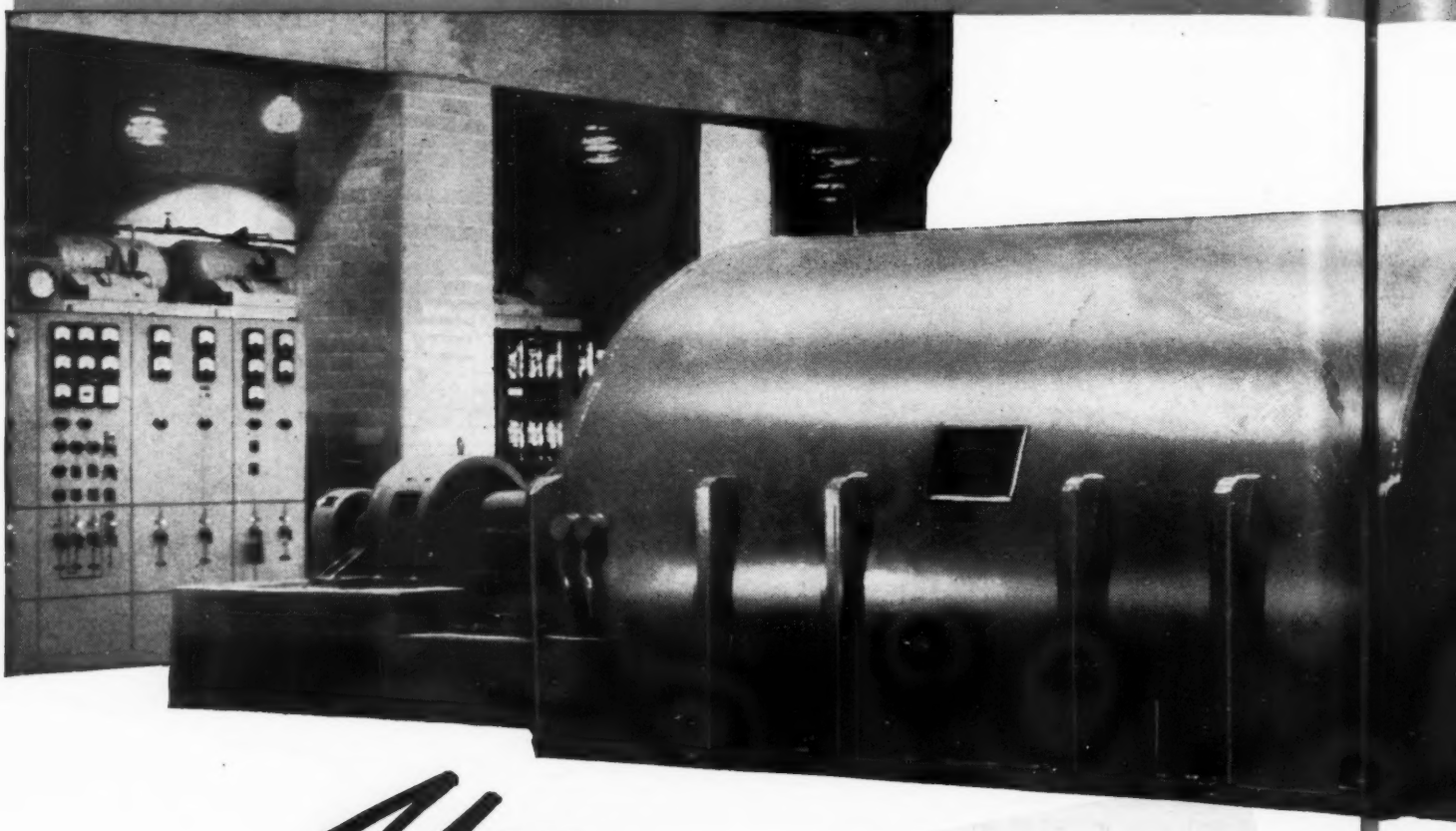
Many years of service, in hundreds of installations, prove conclusively that the Sturtevant E-R (erosion resistant) wheel gives two to four times longer life, lower maintenance, and higher efficiency. For more information write: Westinghouse Electric Corporation, Sturtevant Division, 116 Readville Ave., Hyde Park, Boston 36, Mass.

YOU CAN BE SURE...IF IT'S

Westinghouse

80123

TURBINES MUST



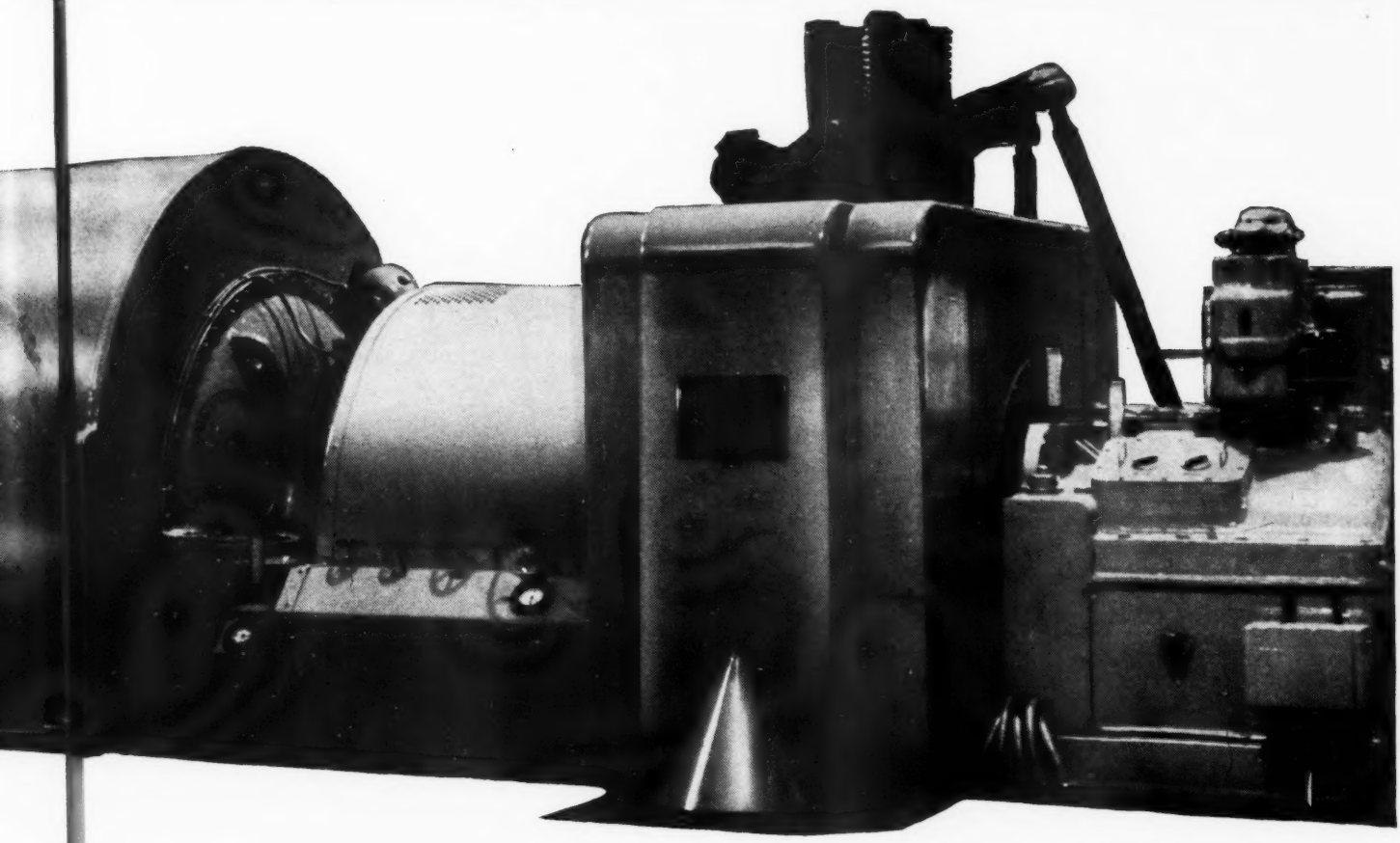
...Use SINTURLITE OIL

Time out needed for cleaning or changing turbine oil is greatly reduced when Sinclair SINTURLITE is the lubricant. With SINTURLITE OIL on the job the circulating oil flows freely...continuously...keeps new oil qualities and delivers full lubricating value year in and year out.

SINCLAIR

YOUR NEAREST SINCLAIR AGENT WILL GLADLY ARRANGE

BE KEPT GOING



Sinclair SINTURLITE OILS have set an enviable performance record for standing up in the grueling day in and day out grind of continuous turbine service. SINTURLITE'S inherent high oxidation stability is strengthened by proven additives. Sludge formation and acid value are checked. Protection against rust trouble is assured because SINTURLITE OILS are rust inhibited. All the lubricating requirements prescribed by the turbine builders are provided by SINTURLITE—with margins to spare. Try SINTURLITE in your turbines.

INDUSTRIAL OILS

FOR LUBRICATION COUNSEL, OR YOU MAY WRITE TO SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

How to keep purchased power under control...

Ohio leather manufacturer keeps efficient balance between generated and purchased electric power with Worthington turbine-generator unit.

At the Ohio Leather Company, Girard, Ohio, purchased power is kept under direct control by means of a steam turbine generator unit which operates as a "reducing valve" to bring boiler pressure down to required levels for use in plant processes.

The turbine, a Worthington 750 KW straight non-condensing type, operates in parallel with the source of purchased power and has an automatic governor control responsive to both purchased or primary power and to plant demands for processing steam. This results in:

- limiting the *maximum* demands on purchased power to a predetermined top level, regardless of plant steam demands.
- limiting the minimum demands to a level which will prevent return flow of power to primary source when plant steam demands are high and power demands low.

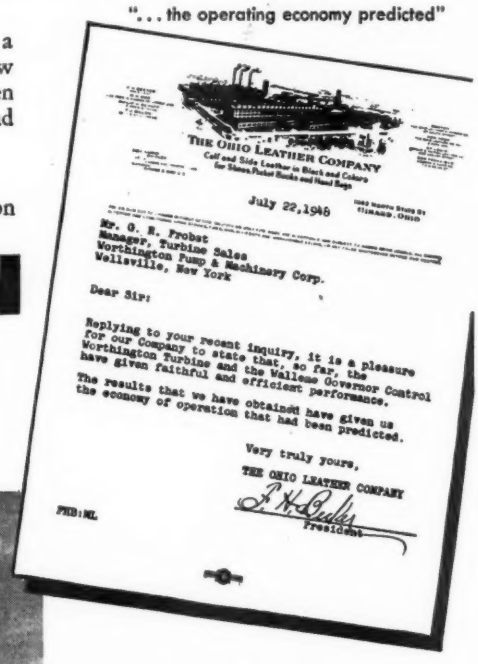
SAVE WITH WORTHINGTON

Savings to date on this installation are at a rate indicating 100% return on the initial investment in three years! For further details that prove *there's more worth in Worthington*, call your nearest Worthington District Office ... or write direct to *Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, New York.*

WORTHINGTON

STEAM TURBINES

"... the operating economy predicted"



THE OHIO LEATHER COMPANY
Calf and Side Leather in Black and Colors for Women's Pocket Books and Hand Bags

July 22, 1948

Mr. G. R. Probst
Manager, Turbine Sales
Worthington Pump & Machinery Corp.
Wellsville, New York

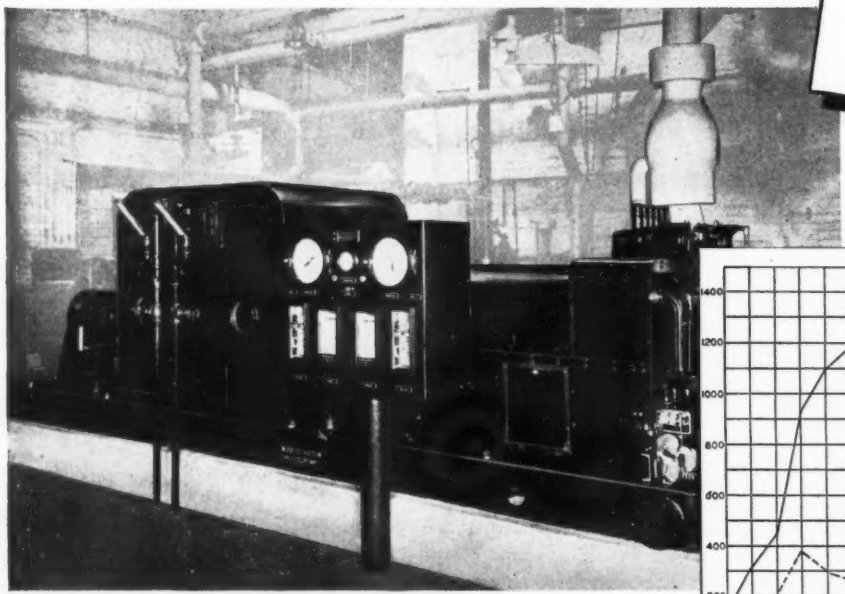
Dear Sir:

Replying to your recent inquiry, it is a pleasure for our Company to state that, so far, the Worthington Turbine and the Wallene Governor Control have given faithful and efficient performance.

The results that we have obtained have given us the economy of operation that had been predicted.

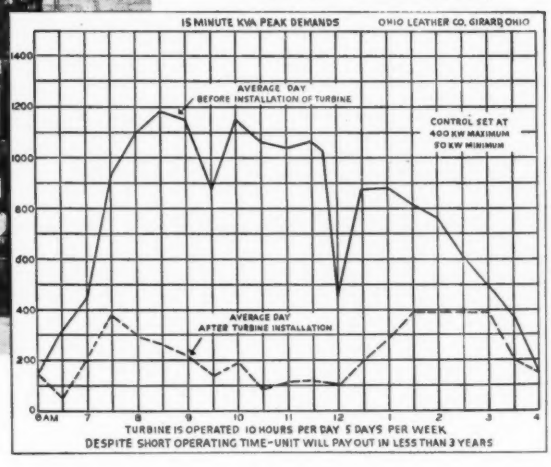
Very truly yours,
THE OHIO LEATHER COMPANY
F. N. Gates
President

FNG:WL



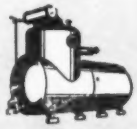
The Ohio Leather Company installation is a direct-connected turbine generator unit, 750 KW, 3600 rpm, 240 volt 3 phase 60 cycle. Steam conditions are 240 psi, 450° F, exhausting at 5 psig. Controls are by Wallene Engineering Co., Cleveland, Ohio.

"BEFORE AND AFTER"
... at the Ohio Leather Company

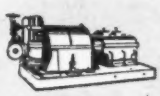


T8-3

A GREAT TEAM IN STEAM

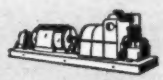


Feed Water Heaters



Multi-Stage Turbines

Boiler Feed Pumps

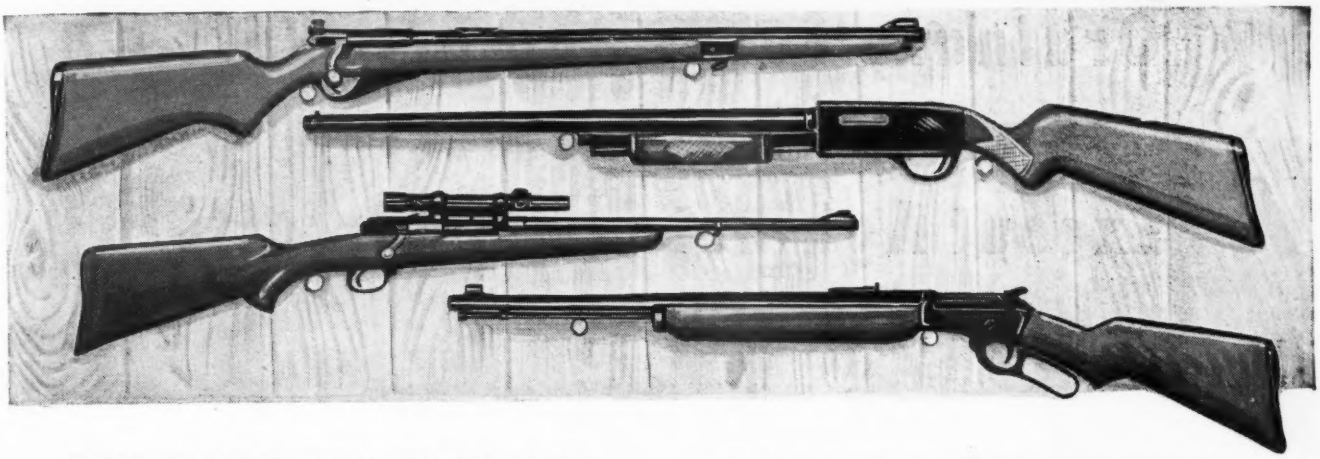


Turbine-Generator Sets

Single-Stage Turbines

Surface Condensers

You Fit Your Gun to Your Target



BUY V-BELTS THE SAME WAY

YOU'D be taking a risk trying to bag an elephant with a bird gun. Potting clay pigeons with a .22 doesn't make sense. And it's just as hopeless to expect the same type of V-belt to handle all the many variations of V-drive operating conditions.

That's why Goodyear offers the most complete line of V-belts—*a special construction to meet every drive requirement.*

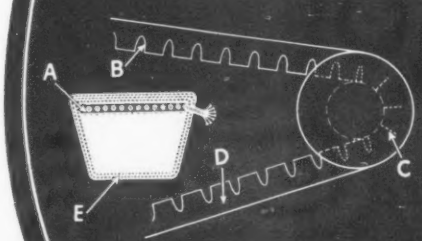
To meet belt stretch and maintenance problems, there's a Goodyear exclusive—COMPASS-V-STEEL belts muscled with wiry steel cables. *High overloads and shock stresses?* Pick a Goodyear belt bodied with multiple high-tensile, resilient cords. *Fast drives, with small pulleys and short centers* call for a belt with high-flex-life—gained by Goodyear's single-plane endless-cord load carriers. *Belts hard to apply?* Choose Goodyear's open-end belting with special fabric body of high fastener strength.

Drive-Fitted by the G.T.M.

Whichever of these time-proved constructions fits your drive best, you can get it in a Goodyear V-belt—also built with oil-resistant, heat-resistant or non-static features when desired. The G.T.M.—Goodyear Technical Man—will gladly recommend the best Goodyear V-belt to give you longer trouble-free service at lowest ultimate cost. Write: Goodyear, V-Belt Sales Dept., Akron 16, Ohio.

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

GTM-Specified COMPASS-V-STEEL BELT



A Load-carrying section of endless high-tensile steel cable.

B Vents open between pulleys, dissipating heat.

C Vents compress rounding pulleys, giving continuous gripping surface.

D Highest quality rubber underbody.

E Sturdy, bias-laid fabric cover resists wear.

Made in all standard cross sections.

1898 GOODYEAR 50 ANNIVERSARY 1948

FOR BELTS, HOSE, MOLDED GOODS, PACKING, TANK LINING built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor.

Compass—T. M. The Goodyear Tire & Rubber Company

GOODYEAR

V-BELTS

With rare exceptions on commercial and industrial installations

Ordinary Fuses and Breakers Do Not Protect Except Against Short-Circuits

But—

FUSETRON

DUAL-ELEMENT FUSES

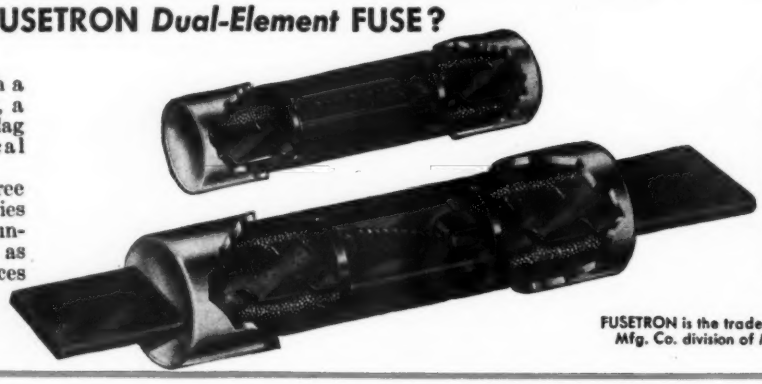
Provide 10 Point Protection—

Count 'em

What is the FUSETRON *Dual-Element* FUSE?

A fuse link combined with a thermal cutout—the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

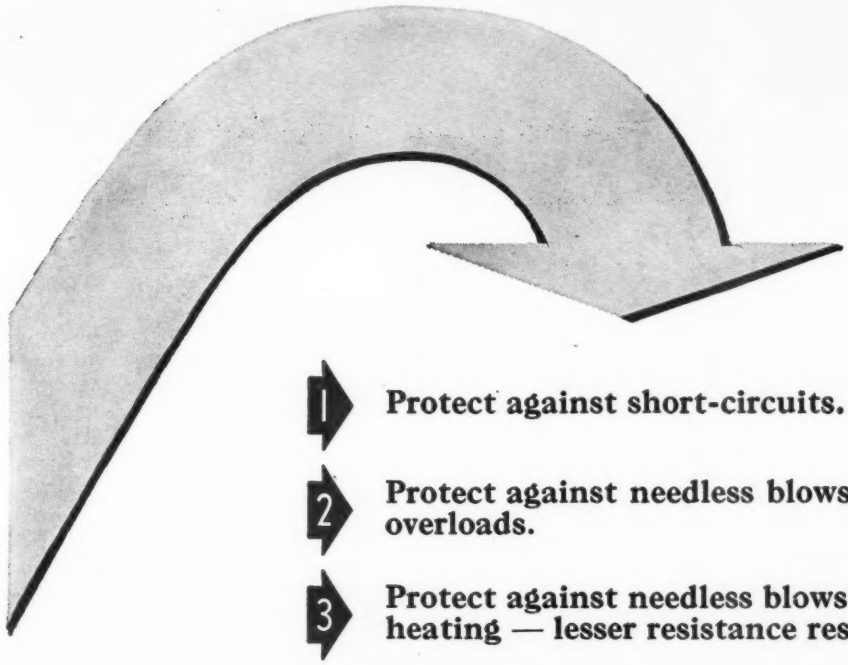


Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

FUSETRON is the trade mark of the Bussmann Mfg. Co. division of McGraw Electric Co.



1. **Protect against short-circuits.**
2. **Protect against needless blows caused by harmless overloads.**
3. **Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.**
4. **Provide thermal protection — for panels and switches against damage from heating due to poor contact.**
5. **Protect motors against burnout from overloading.**
6. **Protect motors against burnout due to single phasing.**
7. **Give DOUBLE burnout protection to large motors — without extra cost.**
8. **Make protection of small motors simple and inexpensive.**
9. **Protect against waste of space and money — permit use of proper size switches and panels.**
10. **Protect coils, transformers and solenoids against burnout.**

FUSETRON DUAL-ELEMENT FUSES *Give ALL-PURPOSE Protection*

One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about Fusetron Dual-Element Fuses.

*Name*_____

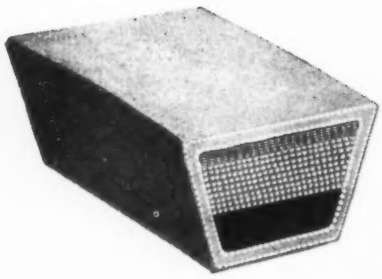
*Title*_____

*Company*_____

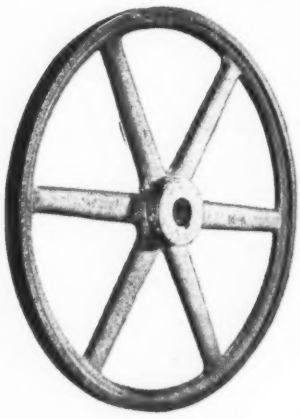
*Address*_____

*City*_____ *State*_____ 1148

Fills Every Need



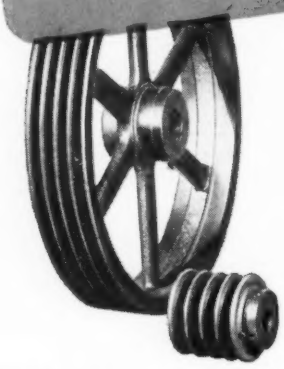
***TEXROPE* SUPER-7 V-BELTS** — All sizes and sections in fractional hp, standard, and wide range. Types to suit all operating conditions. Rayon cord and steel cable construction available for special applications. *All standard sizes available from stock.*



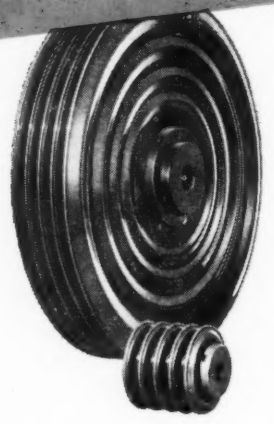
***TEX-IRON* SHEAVES**—Light weight cast iron sheaves for fractional and low horsepower use. Single groove only. Bored integral hub. Fine grain cast iron. Precision machined. Finest low-cost sheave. *All sizes available from stock.*

TEXROPE

Greatest Name in V-Belt Drives



***TEXDRIVE* SHEAVES** — Sturdy cast iron sheaves for 1 to 25 horsepower applications. 1 to 6 grooves for A and B belts. Light but strong. Best all-purpose cast iron sheave. *All sizes and bores from stock.*

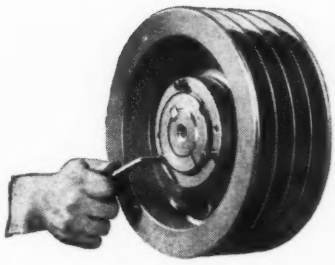


TEXSTEEL SHEAVES — Pressed steel sheaves for applications from ¼ to 25 horsepower. Light weight and rigid. Rolled edges. 1 to 6 grooves, A or B belts. *All sizes and bores available from stock.*

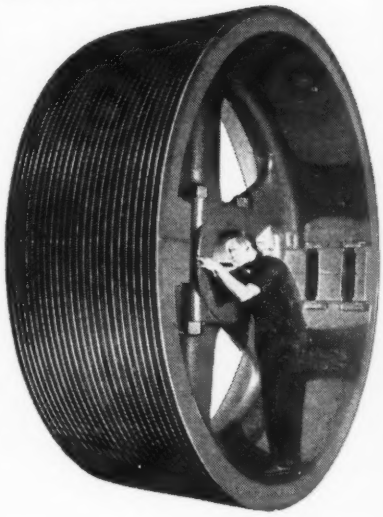
BEST DELIVERY IN THE INDUSTRY!

FINEST ENGINEERING TALENT!

for V-Belt Drives!



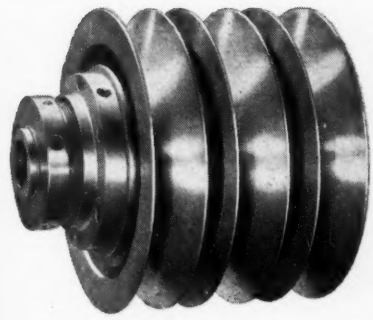
***MAGIC-GRIP* SHEAVES** — Semi-steel casting with interchangeable, patented taper bushings. On and off in a jiffy. Cannot shake loose. 2 to 12 grooves for B, C and D belts. 2 to 250 horsepower. *All sizes available from stock.*



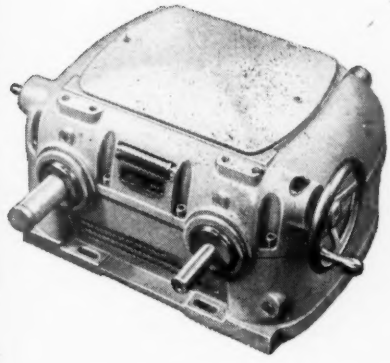
STANDARD CAST IRON SHEAVES — Made to order from stock patterns. 1 to 14 grooves for A, B, C, D, or E belts. 1 to 1000 horsepower. Split sheave or split hub. Good delivery. *Check your Texrope dealer or A-C District Office.*

***VARI-PITCH* STANDARD SHEAVES** — Speed range of 9% to 28% on drives of 1 to 300 horsepower, using A, B, C, D, or E belts. 2 to 10 grooves. Available with Motion Control or Stationary Control. Good delivery. *Check your Texrope dealer or A-C Office.*

SPECIAL CAST IRON AND STEEL SHEAVES — Any number of grooves, A, B, C, D, or E belts. Engineered for applications up to 6000 horsepower. Foundry and machine shops equipped to handle work of any size. Good delivery. *Check your Texrope dealer or A-C District Office.*



***VARI-PITCH* WIDE RANGE SHEAVES** — Speed range up to 100%. 1 to 4 grooves, Q and R belts. Fractional to 30 horsepower. Stationary and Motion Control. Good delivery. *Check your dealer or A-C Office.*



***VARI-PITCH* SPEED CHANGERS** — Wide Range Vari-Pitch sheaves controlled by single handwheel. Capacity: 1½ to 75 horsepower. 375% speed range. For quick speed changes and close control. Good delivery. *Check your Texrope dealer or A-C Office.*

NOW YOU CAN GET nearly every standard V-belt drive component from Texrope stocks. Even on non-stock items, Texrope delivery is the best in the industry. And Texrope is the *only* brand that meets every V-belt need. Whatever you need in V-belt drives, call your Texrope dealer or A-C Office.

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Texrope Super-7 V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

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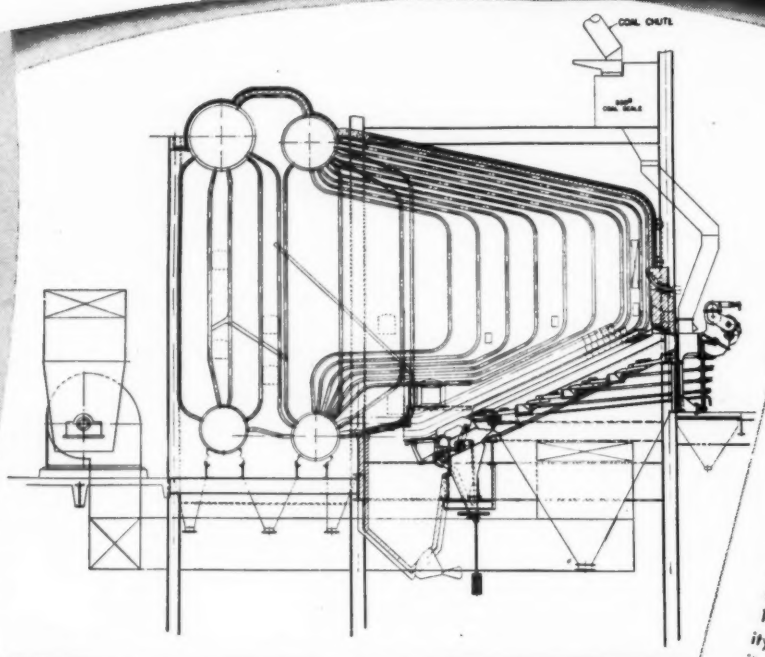
Originators of the Multiple V-belt Drive for Industry

Here's the Stoker for: **LOWER POWER COSTS**
FREEDOM FROM STACK NUISANCE
MAXIMUM FUEL FLEXIBILITY



Recent Installation Burns Low Grade Fuels

A large Eastern manufacturing plant uses a Taylor Multiple Retort, Underfeed Stoker with continuous ash discharge. The unit operates continuously at 125,000 lbs. per hour although designed for 105,000 lbs. per hr. Designed to burn bituminous coal with 16% ash content and heating value of 12,800 BTUs per lb., it recently handled strip mine coal having only 10,000 BTUs per lb., proving its ability to burn low grade fuels and carry its rated capacity.

Taylor is the stoker that beats the high cost of fuels. It has been proved in installation after installation that Taylor Stokers permit the use of a wide variety of type and sizes of fuels. You can feed the Taylor Stoker any kind of coal that's convenient to you . . . for price, labor, delivery and mine location.

Taylor's precision control feed mechanism and better air flow means thorough combustion, maximum fuel economy, and *freedom from stack nuisance.* Simplified construction results in fewer moving, longer-wearing parts, higher operating efficiency, and lower boiler outages. These and many other exclusive features combined add up to efficient, low-cost steam production.

Get more information about the flexible, versatile Æ Taylor Stoker now. Write to us today for literature and engineering help. Ask us to make recommendations—no obligation.

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Inside the Great Bend, Kansas plant of the Central Kansas Electric Cooperative — the first R. E. A. power plant in Kansas and the first Supercharged Dual Fuel central station in the world. Manager Bill Groh at the control of one of two Worthington Type SEHGO-8 Dual Fuel Diesel Engines.

"TOTAL FUEL AND LUBRICANT COST PER KWH—$0.0015+!"

Kansas R. E. A. Station Reports Steady Savings With Worthington Supercharged Dual Fuel Diesels

One way to get the real low-down on economical generation of electric power is from a progressive R. E. A. plant. Here, in part, is what the Central Kansas Electric Cooperative Association has to say about its Worthington Dual Fuel Diesel equipment:

"Our engines have run approximately 3050 and 4100 hours, respectively, under loads varying from 300 to 1160 KW. Operation has been satisfactory at all loads.

"One remarkable point is the low lubricating oil consumption . . . Also, we have had very little maintenance work.

"The past month the total fuel and lubricant cost per KWH generated has been 1.517 mills. . . . The saving of gas over fuel oil is very great.

"A fire necessitated shutting off our gas line for 12 hours. We switched to oil Diesel operation without any interruption."

Economy In Every Detail

With Worthington Dual Fuel Diesels you get outstanding thermal efficiency on the cheapest fuel available — oil, gas or oil-and-gas in any ratio — while Worthington's long leadership in developing Diesel design and performance means additional power for every operating-dollar you spend. For further proof that *there's more worth in Worthington*, contact *Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N. Y.*

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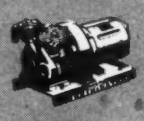
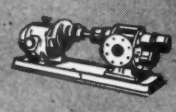
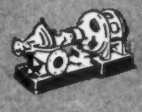
Diesel engines, 150 to 2,640 hp . . . gas engines, 175 to 1,720 hp . . . dual fuel engines, 225 to 2,640 hp.



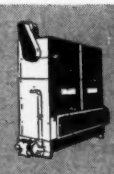
Air King Compressors



Oil Transfer Pumps



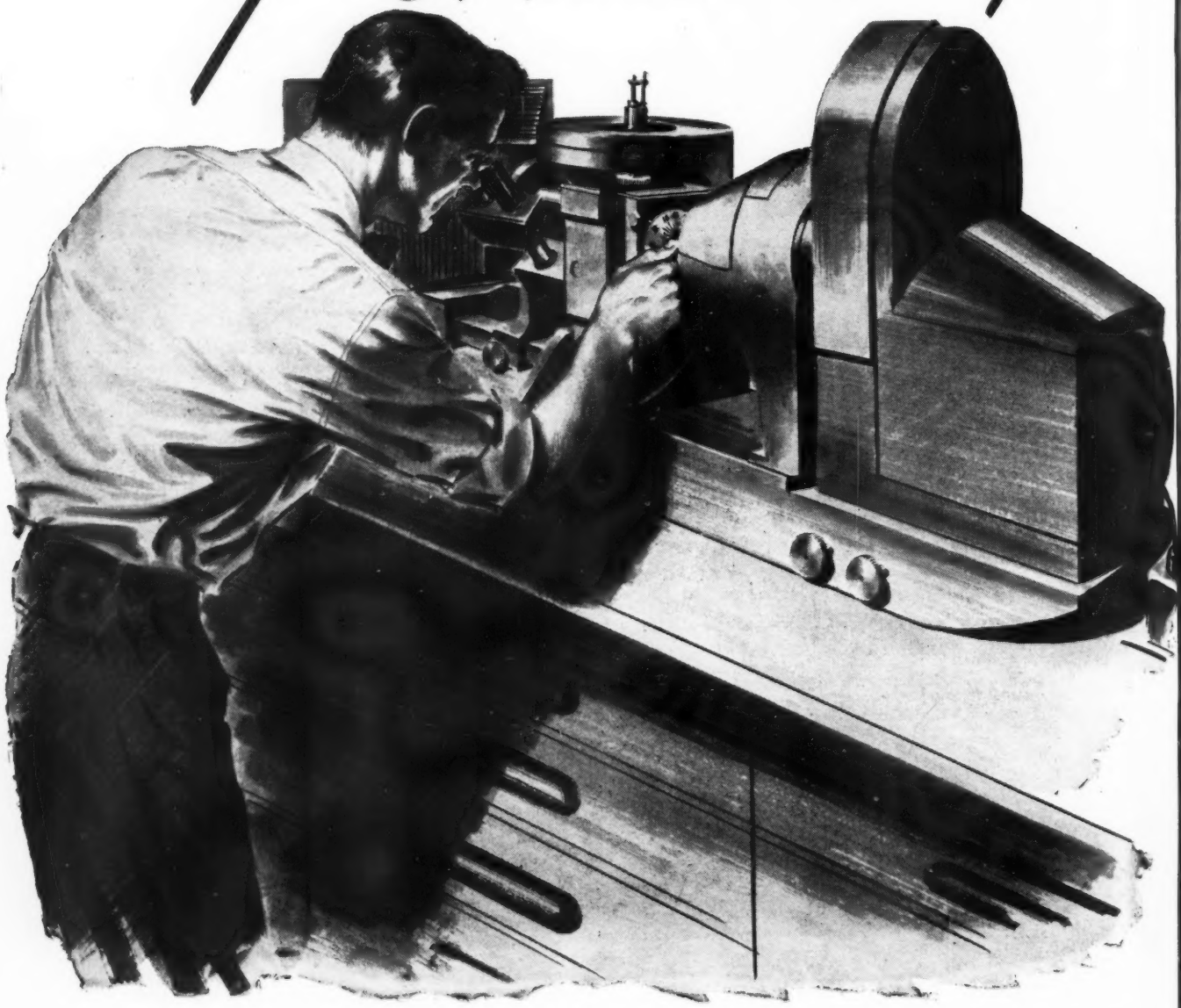
Cooling Water Circulating Pumps



Evaporative Type Engine Water Cooler

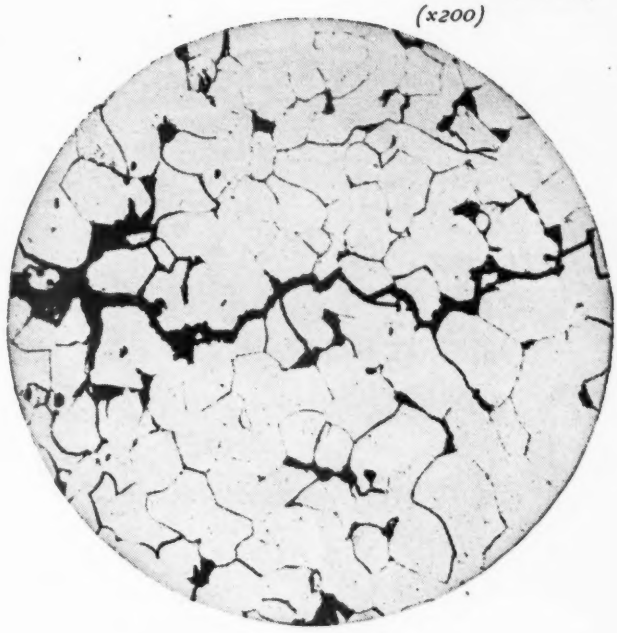
Normal low-carbon boiler steel (×1000)

Portraits of



Metallic structure of overheated tube which has been quenched (x200)

Typical intergranular crack caused by caustic embrittlement (x200)



Trouble

Many kinds of boiler metal trouble leave distinctive marks in the structure of the metal itself, and in many cases, these traces are an important clue—if not the only clue—to the exact nature of the trouble.

That's why the metallographic microscope is so important a tool in Hall Laboratories. Samples of metal cut from failed tubes or other damaged boiler metal parts are carefully polished and etched, then studied under this microscope. Photomicrographs, at suitable magnification—up to two thousand times if required—may be taken for further study.

This kind of metallographic examination may show, for example, whether a tube failure is due to transcrystalline stress corrosion cracking, or to intergranular caustic or hydrogen embrittlement. It provides positive evidence when overheating has occurred, and many times gives corroborative evidence which supplements the facts gained from chemical and other methods of analysis.

Metallographic examination is only one aspect of the careful study Hall Laboratories devotes to your boiler problems—and this careful study is one reason why so many plants, of all sizes, in all parts of the country use Hall service.

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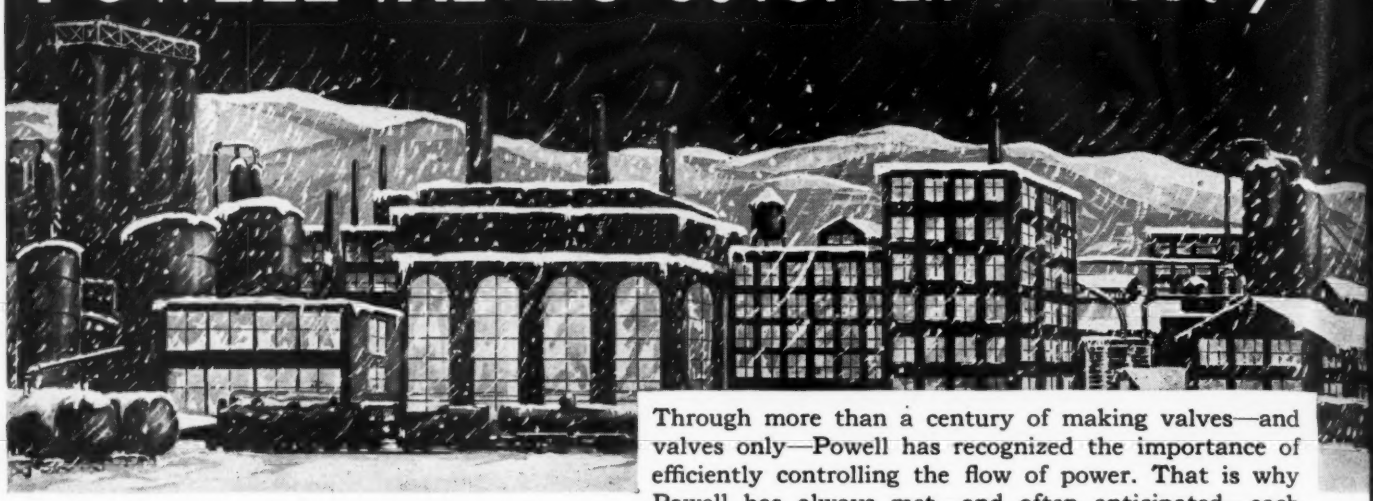

Through more than a century of making valves—and valves only—Powell has recognized the importance of efficiently controlling the flow of power. That is why Powell has always met—and often anticipated—each new development in this vast field.

The result—an amazingly complete Line of Valves for Power Plants, from the small individual plant to the biggest utility. This includes Bronze and Iron Valves of all types and, to meet the modern trend toward higher pressures and temperatures, a most complete line of Cast Steel Valves—*including many special designs*—in pressure classes from 150 to 2500 pounds.

Fig. 11393 W.E.—Class 1500-pound Cast Steel Flangeless Bonnet Non-return Angle Valve with welding ends; offset inlet and Stellite-faced seat and disc. Toggle operated.

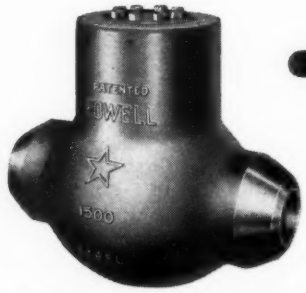

Fig. 11365 W. E.—Class 1500-pound Cast Steel Horizontal Lift Check Valve with piston guided disc, welding ends and the new flangeless cap.

Fig. 1303 W.E.—Class 1500-pound Cast Steel Welded Bonnet Gate Valve with welding ends. Gear operated. Illustration shows gear cover removed.

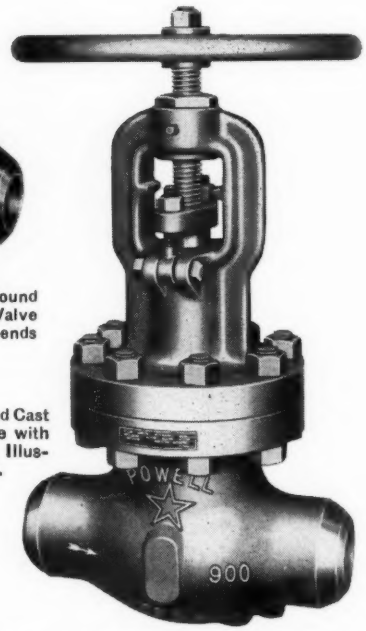

Fig. 9031 W. E.—Class 900-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke.

POWELL

—AND WHERE THERE'S INDUSTRY THERE'S POWER

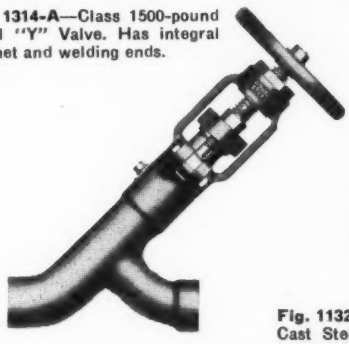

Fig. 1314-A—Class 1500-pound Steel "Y" Valve. Has integral bonnet and welding ends.

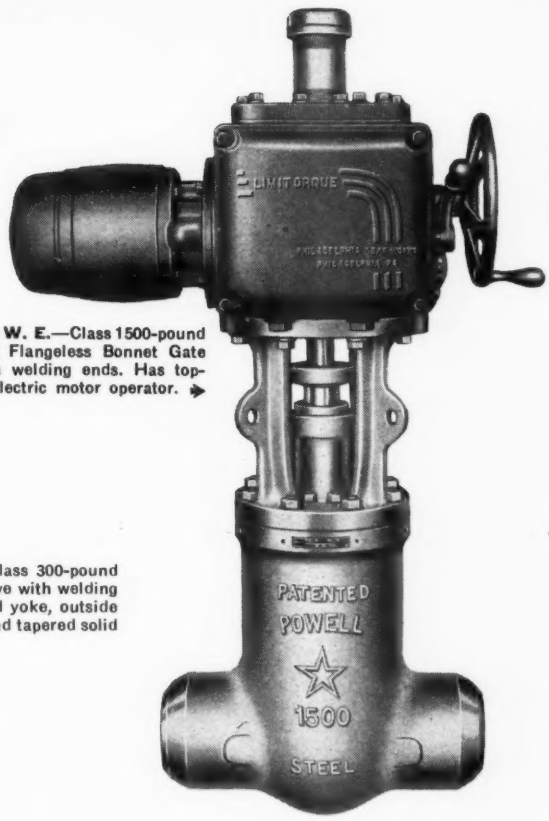

Fig. 11323 W. E.—Class 1500-pound Cast Steel Flangeless Bonnet Gate Valve with welding ends. Has top-mounted electric motor operator. ➧

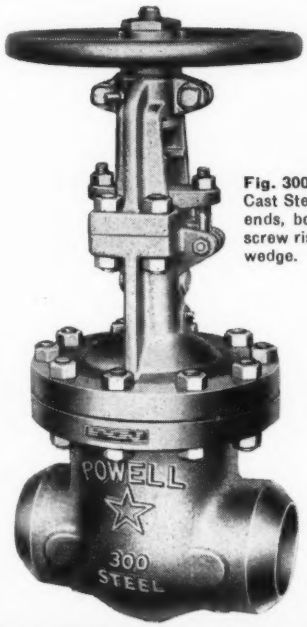

Fig. 3003 W. E.—Class 300-pound Cast Steel Gate Valve with welding ends, bolted flanged yoke, outside screw rising stem and tapered solid wedge.

Fig. 11303 W. E.—Class 1500-pound Cast Steel Flangeless Bonnet Gate Valve. Venturi type. Welding Ends. Spur gear operated.

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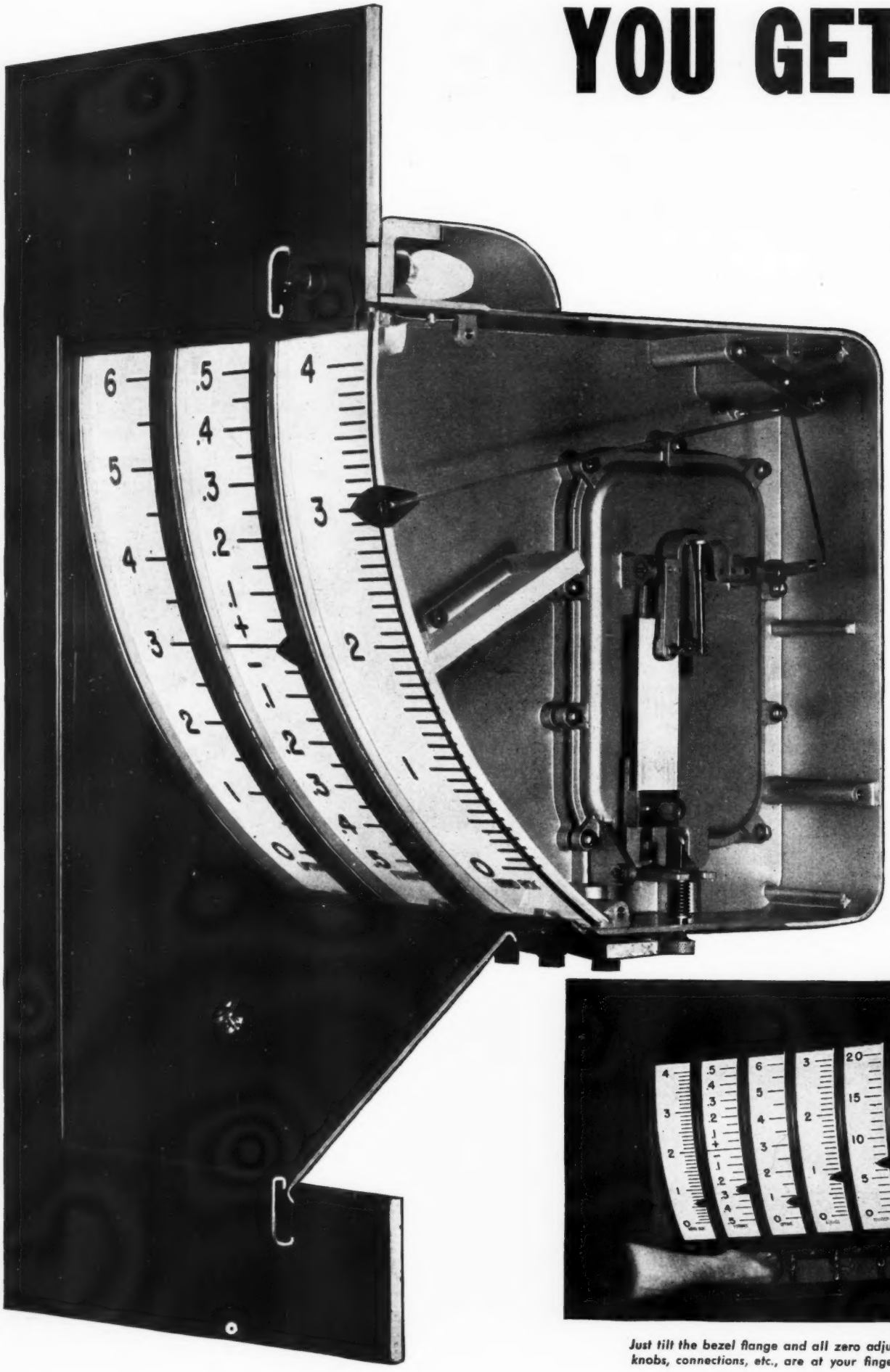

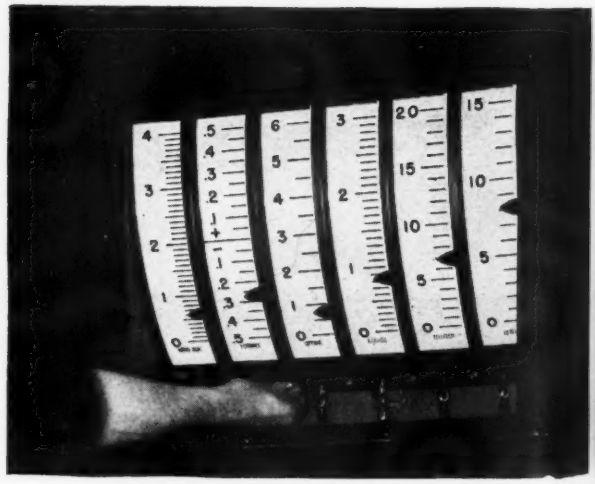

Just tilt the bezel flange and all zero adjustment knobs, connections, etc., are at your finger tips.

ALL OF THESE FEATURES

In The Republic Multi-Point Draft and Pressure Gage

1. EASY TO OPERATE: All adjustments can be made from the front of the gage regardless of whether it be flush or projected mounted. On the flush mounted gage a bezel flange, which tilts back, conceals the zero adjusting knobs, pipe connections, mounting bolts, etc.

2. INDIVIDUAL UNITS: Each draft or pressure element is individually housed in a die cast case forming a complete compact unit.

3. UNITS EASILY REMOVED: The individual units can be removed from the front of the gage as you would remove a book from a shelf. This can be easily and quickly done without interfering with the operation of any other unit.

4. EASY TO MAINTAIN: Because each element is a complete unit in itself which can be easily removed, maintenance is greatly simplified.

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6. UNIFORM SIZE: All units are of one standard size which permits new units to be added or interchanged as required.

7. ALL STANDARD RANGES: Elements are supplied for all standard ranges of draft, pressure or differential.

8. SENSITIVE DIAPHRAGM: All elements, except those for high pressures, are actuated by an extremely sensitive bellows type of diaphragm.

9. MULTIPLE UNITS: Any number of units of draft, pressure or differential may be combined in one multi-point gage which is supplied for either flush or projected mounting.

10. FLOW, CO_2, TEMPERATURE: Developed primarily to indicate drafts, pressures and differentials, the Republic multi-point gage can also be made to indicate other quantities such as flow, CO_2, temperature, liquid level, etc. In each case the corresponding standard Republic instrument is used.

The sectional view shown on the opposite page illustrates the extreme simplicity and compactness of the Republic Multi-Point Draft and Pressure Gage. Every detail has been designed to assure ease of maintenance and continuous operation as well as accuracy and sensitivity.

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REPUBLIC FLOW METERS CO.

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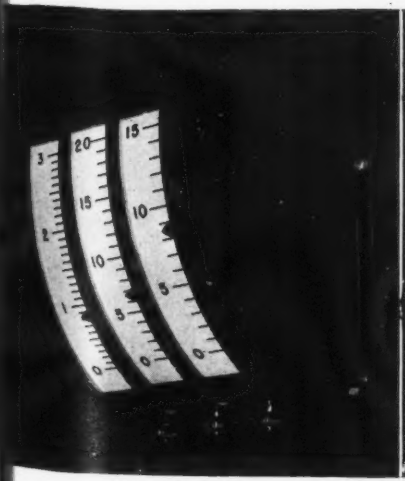
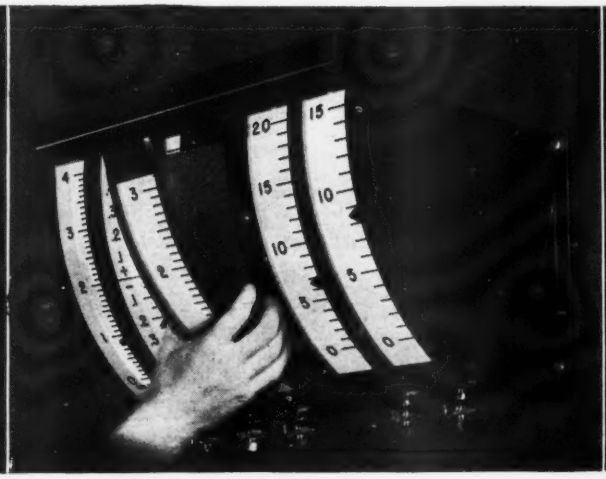


Supplied for either flush or projected mounting.

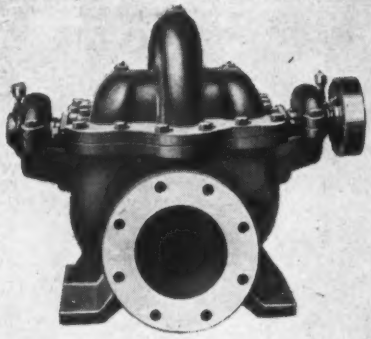


Any unit can be easily removed from the front without disturbing any other unit.

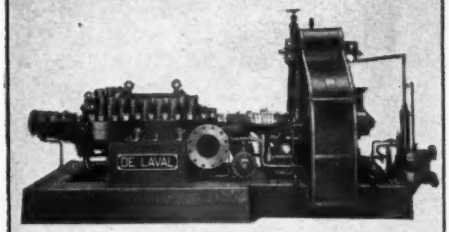
Each element is a complete, compact, sealed unit.

De Laval Centrifugal Pumps

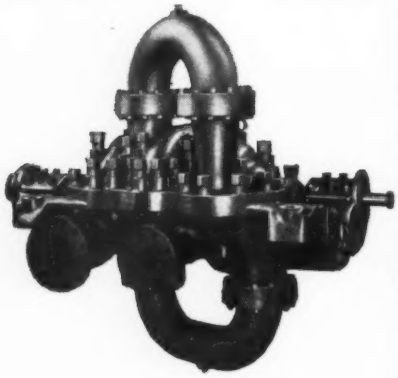
for all purposes



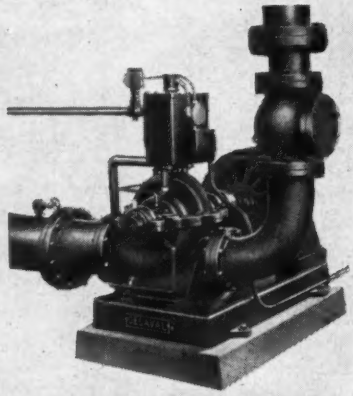
SINGLE STAGE, DOUBLE SUCTION PUMP made in capacities ranging from less than 100 gpm to upwards of 75,000 gpm.



1600 PSI BOILER FEED PUMP. Designed for trouble free, high pressure, high temperature service.



FOUR STAGE, OPPOSED IMPELLER PUMP. Built in two to six stages, for pressures up to 1000 psi.



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MIXED FLOW PUMPS. For handling large volumes at relatively low heads.

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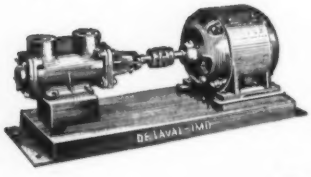

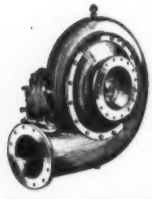

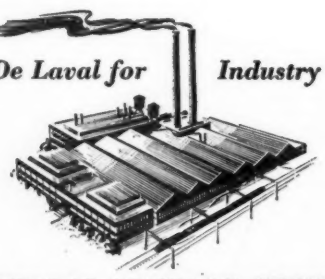

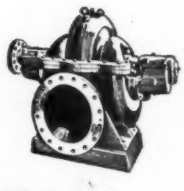

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NOVEMBER 1948 VOLUME 92, NUMBER 11

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

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TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
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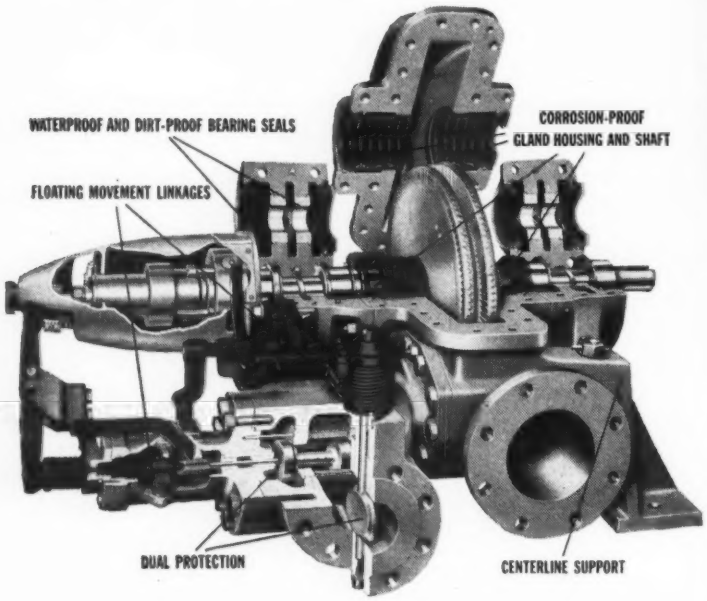
Where the going is

Water-test periods running for hours and hours with turbine *operating* and *standing still*—prove the effectiveness of Type E bearing seals against water contamination of the lubricating oil.

Dust-like, hard abrasive sprayed on the Type E operating at full speed . . . none of the abrasive entered the bearing housing . . . governing and overspeed mechanisms operated freely.

Floating movement of the governing and trip linkages is assured with corrosion-resisting parts, ball and socket joints, large clearance for free movement of the assemblies. The unique design of Type E prevents the accumulation of sludge or mud packs where the operation of the governing or trip linkages might be impaired.

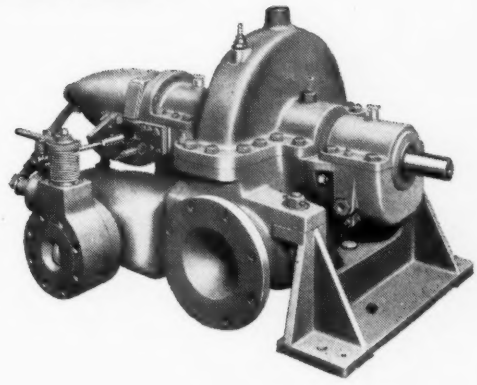


Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

TOUGH!

Count on TYPE E



THE GENERAL-PURPOSE TURBINES THAT CAN "TAKE IT"

In wet or dry locations . . . outdoors in any kind of weather . . . in subbasements . . . or anywhere a turbine may be required . . . the Type E operates dependably, economically and efficiently.

The Type E is engineered to eliminate or minimize many maintenance problems that could be troublesome, ordinarily. Such features as weatherproof bearing seals, corrosion-resisting gland zones, centerline support, Dual Protection against overspeed, floating movement of governing and trip linkages, and parts interchangeability are a few of the "reasons why" Type E turbines are the choice for rugged, trouble-free, economical drives.

Get all the facts. Call your nearest Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. Send for Booklet B-3896. J-50488-A

TYPE E Turbines do these jobs well!

PUMP DRIVES

FAN DRIVES

COMPRESSOR DRIVES

A-C AND D-C GENERATOR DRIVES

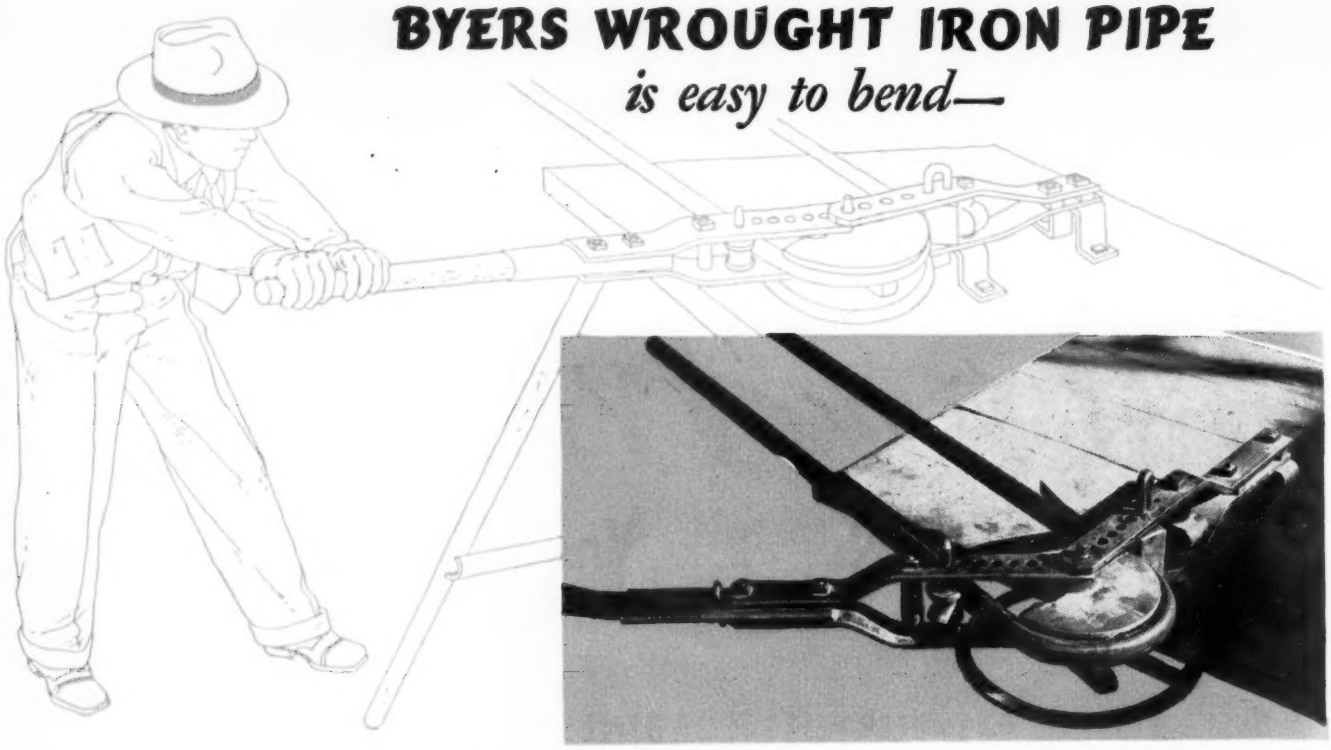
DRIVES FOR
Paper Machines, Jordans, Beaters, Coal Pulverizers and Line Shafts

YOU CAN BE SURE... IF IT'S Westinghouse

Steam Headquarters

WESTINGHOUSE

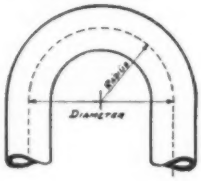
BYERS WROUGHT IRON PIPE
is easy to bend—



If you are installing continuous coils in a radiant heating system, or are required to bend pipe in connection with any type of system, you'll find that wrought iron —in addition to its corrosion resistance, fatigue resistance and weldability—has *ductility* that permits close bends to be readily made cold, with simple equipment.

Minimum Radii of Cold Bends

Some degree of flattening permitted



Size of Pipe	Minimum Radius of Bend Standard Weight	Extra Strong
3/8"	1.10"	1.10"
1/2"	1.40"	1.40"
3/4"	1.75"	1.75"
1"	2.15"	2.15"
1 1/4"	2.75"	2.75"
1 1/2"	3.50"	3.10"
2"	5.50"	4.60"

The minimum bend radii recommended for various sizes of Byers Wrought Iron pipe, both standard weight and extra strong, are shown in the table.

In bending wrought iron pipe, three fundamental requirements should be observed. (1) The force should be applied as a slow, steady pressure—to permit the material to flow. (2) The bending stress should be applied successively to short sections of the pipe. And, (3) the bent or stretched portion should be advanced *out* of the bending zone, so as not to be subjected to further stress. The small diagrams at right illustrate the wrong and correct methods.

For large-radius bends the conventional pipe bending tables, employing pins, are satisfactory. For the production of close radii bends, however, it is desirable to employ some form of mechanical pipe bending device. In several instances, customers have used "homemade" equipment with good results, but a number of makes and models of inexpensive pipe benders for field and shop use are available, and generally prove a good investment.

Our bulletin, "The Bending and Flanging of Wrought Iron Pipe" discusses both the principles and practice of cold and hot pipe bending. If you would like a copy for your file, or to pass on to your workmen, we will be glad to supply you.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N. Y.

Here original bent sections are stressed when successive bends are made.

Here bent sections advance out of bending zone, are not subjected to further stress.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • NOVEMBER • 1948 • ESTABLISHED IN 1882

Go See For Yourself

IF ANY ENGINEERING EDITOR needed to be reminded of the need to travel his publisher would soon supply the necessary urge. The old-timers in this office will never forget the wise sayings of the late James H McGraw, Sr. "I want editors to make expense accounts."—also, "A good editor wears out his shoes faster than the seat of his pants."

Now naturally Mr McGraw didn't try to keep track of what each editor was doing on field trips. He merely lived by his conviction that no industrial or engineering magazine can do a real job for its readers unless the editors keep inside of what's going on. He knew that can't be done just by letters, useful as they are. Like "Kilroy," you have to be there in person.

To a lesser degree this same thinking applies to power engineers. Every few weeks the ambitious engineer should drop in on some nearby plant. And once or twice a year he ought to roam far afield—say, to some major power show or engineering meeting, and take in a few plant-inspection trips on the side.

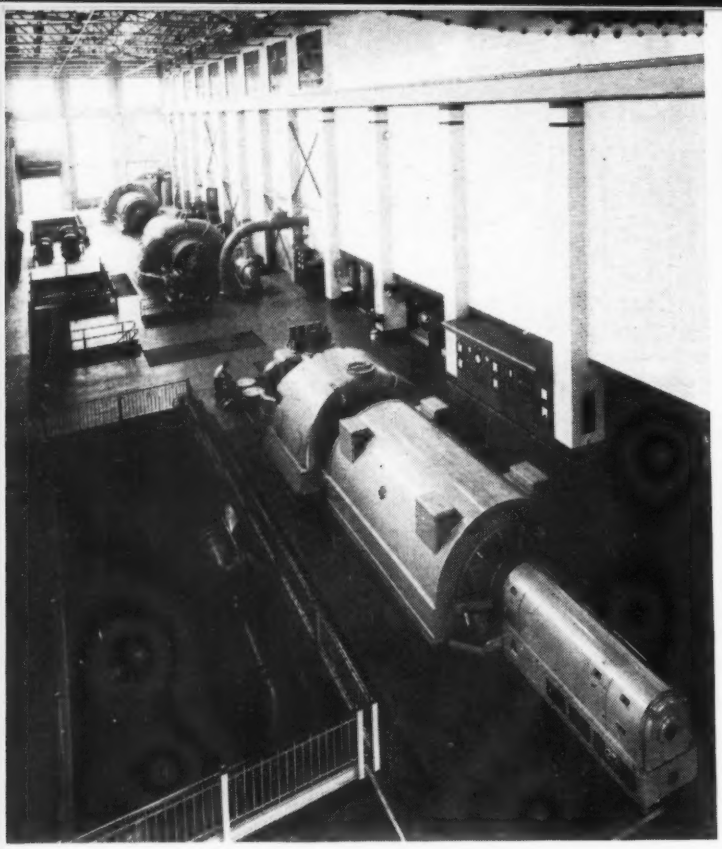
Smart top management will see the need for this, allow the time, and maybe help finance the trips as a sound investment.

All this is brought to mind by a letter from A T Appleton of the Hydro Electric System of the City of Winnipeg, Canada. Years ago Mr Appleton visited a large steam power plant burning pulverized coal. The eight mills were lined up in a long dingy row. Two attendants walked back and forth along the aisle behind the mills. To save steps, one of the men hooked a little flag to the shaft of each star feed. When a flag stopped waving he hopped.

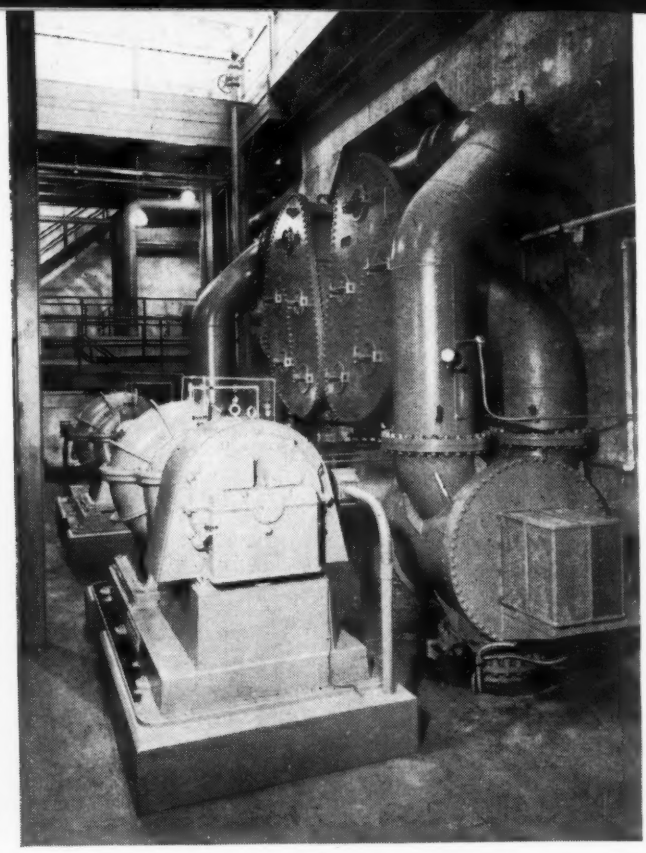
Now Mr Appleton had just installed one of the largest pulverized-fuel plants in the West. He adopted the flag idea with improvements—hooked centrifugal switches to his own star feeds, wiring them up to the no-voltage releases of the main starting oil switches. Later he extended the idea to provide safety interlocks for the entire coal-preparation system.

Appleton says that this simple idea, picked up on one trip, has saved the full time of one man—in all, many thousands of dollars over a period of years. The least costly experience is what you borrow from the other fellow.

This line of thought brings us right to the doorsteps of Grand Central Palace, New York, where the National Exhibition of Power and Mechanical Engineering will open on November 29. You must wait 24 months for another equally good chance to see what's new in power-service equipment. Why not pack your bags and head for New York and new ideas?



NEW NO. 3 UNIT RATED 35,000 KW, in foreground, can produce a maximum of 43,750 kw with 850-psig 900-F steam



MAIN CONDENSER COOLING-WATER CIRCUIT is fitted with reversing valve for backwashing unit while carrying generation

High-Pressure Boilers Serve New

New high-pressure unit generates enough steam to help develop full load on existing low-pressure units using topping turbine to reduce pressure. Station name was changed to honor operating superintendent who has run plant since first constructed

By **THOMAS Y MULLEN,** ***Sponsor Engineer, Gilbert Associates, Inc.***

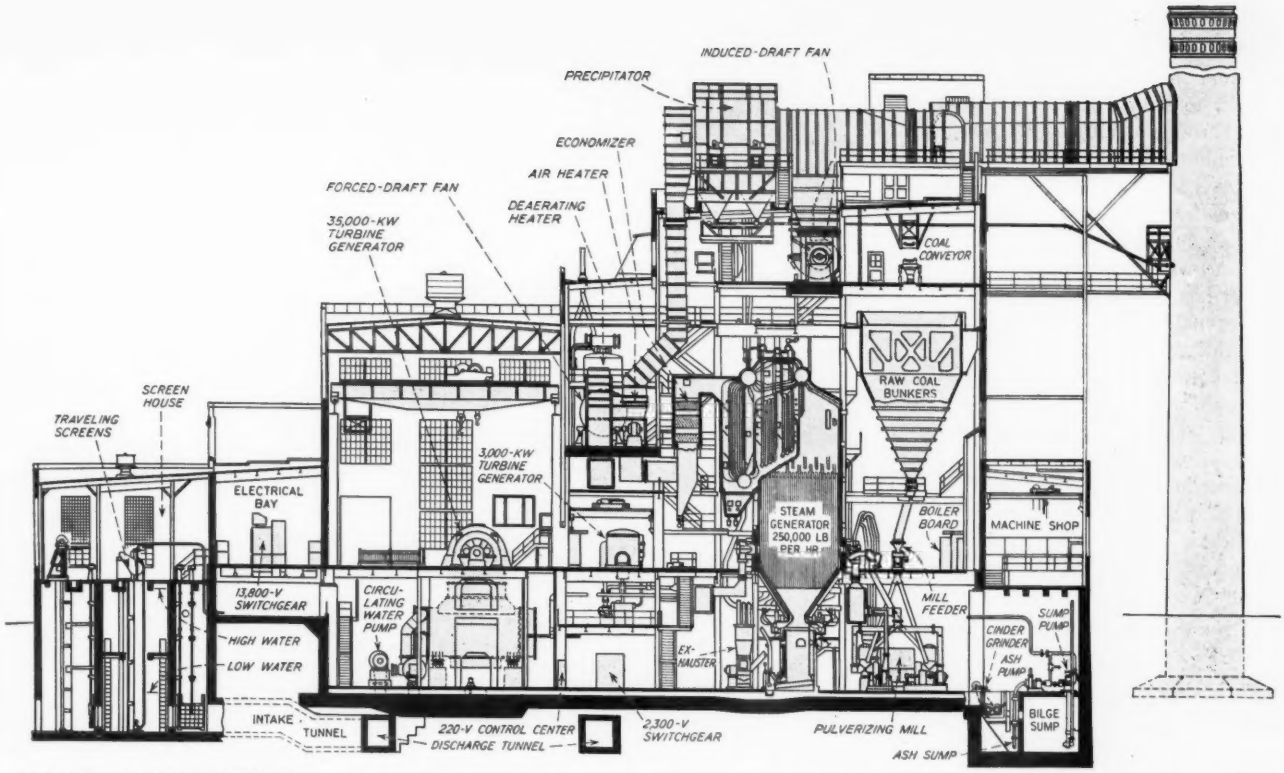
▶ On June 25, 1948, the former Middletown Station of the Metropolitan Edison Co in Middletown, Pa. was renamed the Crawford Station in honor of Harold J Crawford, plant superintendent of the station since the first unit was placed in operation. This station, on the west shore of the Susquehanna River, was the first central station in this country to use all pulverized-bituminous coal-fired boilers. Crawford Station is known for its early experiments in pulverizing and burning anthracite coal dredged from the bottom of the river adjacent to the station.

The "fishtail" burners and air-cooled refractory walls, which were in the original boilers here, have been largely displaced by turbulent burners and watercooled furnace walls in recent pulverized-bituminous-fired boiler installations. Burners like those included in the original Middletown installations and similar air-cooled refractory walls, or sections of furnace walls, are, however, used in some of the most recent anthracite installations to maintain ignition.

New Unit. Design of the latest Crawford extension started in 1941 when the Metropolitan Edison Co., foreseeing need for added generating capacity in this area, contracted with The Atlantic Utility Service Corp (predecessors of Gilbert Associates, Inc) for engineering and design of a plant extension incorporating one 35,000-kw turbine-generator and two 200,000-lb-per-hr steam-generating units and all associated equipment.

Engineering and design work proceeded on this basis until 1942 when the federal government refused to grant priority for continuation of this project. The Edison Co realized that the need for this extension would be increased by this delay, and also excessive cancellation charges would be encountered if the project were dropped. Hence, hold orders were placed on all equipment contracted for, and engineering and design suspended until priorities could be secured.

In June 1945, when priorities were finally obtained, work was resumed. Alterations to existing No. 2 turbine had increased its capacity from 30,000 to 35,000 kw. But the poorer-quality coals, which were now being burned as a result of the war, made it impossible for the existing boilers to produce sufficient steam to operate the turbines



TWO STEAM GENERATORS, No. 7 and 8, serve the new condensing and backpressure turbines. Condensers in the saturated steam header of the superheater, using feedwater for cooling, control outlet-steam temperature. Pulverized coal is the fuel

Condensing and Topping Turbines

at full capacity, which was desirable.

Consultation with the Foster Wheeler Corp revealed that steam-generator design had not proceeded so far that it was impracticable to change their capacity. Accordingly, these units were increased from 200,000 to 250,000 lb per hr each. In addition to the 35,000-kw (43,750-kw maximum) turbine-generator, a 3000-kw (3750-kw maximum) pressure-reducing turbine-generator exhausting to the old plant's main steam header was purchased.

Steam generators were designed for 1000-psig maximum allowable working pressure to deliver steam at the superheater outlet at a pressure of 875 psig and 910 F temperature.

The 35,000-kw turbine was designed for throttle steam at 850 psig and 900 F, exhaust to a condenser, and with bleed points in the 7th, 10th, 14th and 18th stages. The 3000-kw turbine was designed to receive steam at 850 psig, 900 F, and to exhaust at a backpressure of 330 psig. Since the exhaust from this unit has a temperature of about 705 F at rated load, condensate is used to desuperheat it to a temperature of 650 F before entering the steam header serving No. 1 and 2 turbines at a pressure of 325 psig.

The small turbine will normally operate at a throttle flow of 100,000 lb per hr but the stage heaters, pumps, desuperheating station, piping, etc, have been designed to accommodate flows up to 150,000 lb per hr during periods when one boiler is out of service in the low-pressure section of the plant, or when peak loads occur.

Heat Balance. The heat-balance diagram, page 66, shows the major cycle conditions with full capability developed on the large turbine and 150,000-lb-per-hr steam flowing through the small topping unit on its way to units No. 1 and 2.

Condensate leaving the hotwell passes through a low-head condensate pump, inter- and after-condensers of the evactor, the 18th-stage closed heater, and discharges into a tray-type deaerating heater. The deaerating heater, operating at constant pressure of about 2 psig, serves as evaporator condenser for all makeup to the new extension. Supplementary steam to maintain constant deaerator pressure bleeds from the 14th stage at full load and from the 10th stage at light loads. A diaphragm-operated valve controls this steam flow from the turbine. When evaporator vapor exceeds that needed for constant deaerator pressure the diaphragm valve closes completely and a bypass valve around the 18th-stage heater automatically opens to the extent needed to maintain constant deaerator pressure by admitting cooler condensate.

Choice of a fixed-pressure deaerator instead of a "floating" deaerator was based on (1) keeping water flow to the boiler feed pumps at a constant low temperature (2) preference for a loop seal for the deaerator, thus eliminating possibilty of flooding 14th or 10th stage bleed lines because of overflow valve failure (3) simplifying condensate-return system from existing station, which is equipped with constant-pressure deaerators (4) eliminating venting and boiler-feed-pump turbine-shaft sealing problems that would be encountered when pressure within a floating-type deaerating heater would be below atmospheric pressure.

The deaerator discharges to three boiler feed pumps, 300,000-lb-per-hr capacity each, connected in parallel.

Two pumps are motor driven, and one is dual driven. The latter connects solidly to the driving motor on one end and through a clutch-type coupling to a turbine drive on the other end. The clutch-type coupling allows the turbine to remain at rest when the motor drives the pump, but engages automatically as the turbine comes up to speed. The boiler-feed-pump turbine operates in emergencies only, exhausting to the deaerating heater.

The boiler feed pumps discharge through the 14th, 10th and 7th stage heaters and feedwater regulators to the economizers and superheat-control condensers in the saturated-steam headers of the superheaters. From here the feedwater passes into the boiler drum for evaporation.

Air-Gas Cycle. One vane-controlled forced-draft fan serves each boiler, discharging through a regenerative air preheater. Air leaving the preheater at about 510 F passes to the burners as secondary air with a small percentage going to the pulverizers to serve as primary air. A tempering fan between the two pulverizers of each boiler supplies tempering air to the primary air at the pulverizer inlet. Primary air passes through the pulverizers and exhausters to the burners, mixing with the secondary air as it enters the furnace. Flue gas leaving the boiler passes through the economizer and air preheater before entering electrostatic precipitators at about 310 F.

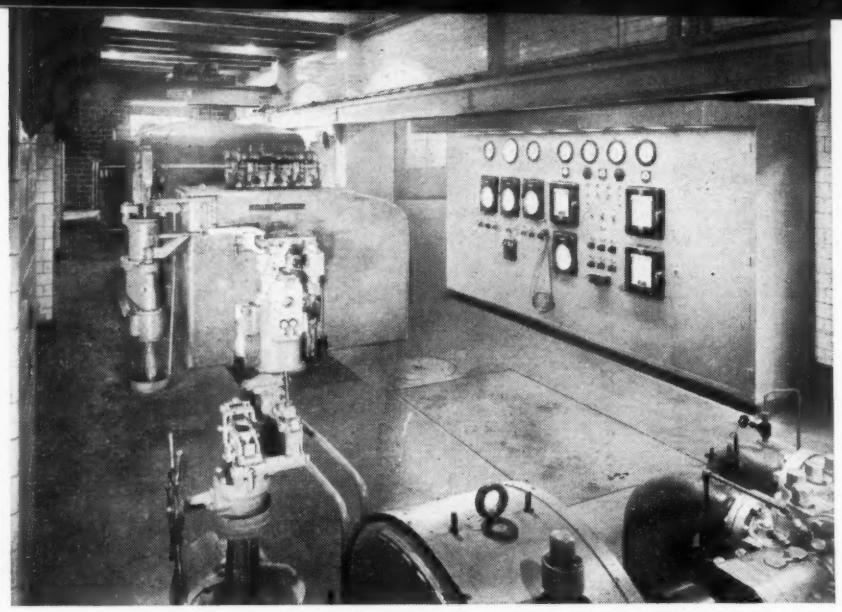
The precipitators, which have a guaranteed flyash-removal efficiency of 94%, are used both to minimize induced-draft fan erosion and eliminate, as much as possible, any smoke nuisance. Smoke would be particularly objectionable to the Middletown airport adjacent to the station.

Gas leaving the precipitator passes through one induced-draft fan for each boiler to a single reinforced concrete chimney common to both boilers. Each i-d fan has a double-extended shaft with a 500-hp 900-rpm motor on one end and a 250-hp 720-rpm motor on the other. Flexible couplings attach both motors rigidly to the fan. The 720-rpm motor may rotate at 900 rpm without ill effects. These 2-speed fans have inlet-vane controls.

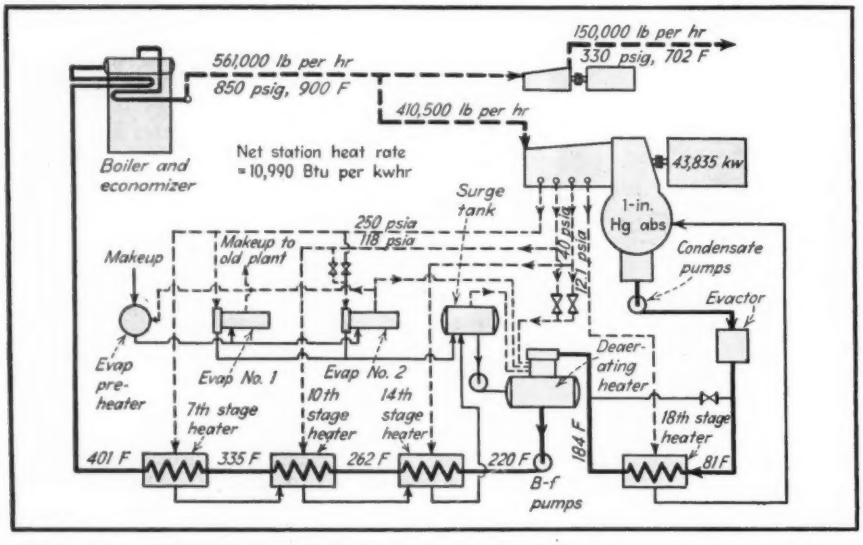
Fuel-Ash Cycle. Coal is delivered on a double railroad siding, which passes through a new track-hopper house. Car-thawing equipment consisting of four pits, each with two oil burners, precedes the track hopper house. Cars entering the house are spotted over either of two 70-ton coal hoppers. A car vibrator carried over these hoppers by a small overhead crane speeds up coal-car emptying. Six reciprocating feeders remove coal from the hoppers at 300 tons per hr feeding it to a flight conveyor, which discharges to a 2-roll crusher.

After reducing coal to 1¼-in. size the crusher discharges it to a gravity-discharge elevator carrying it to either an inclined belt conveyor for transportation to a transfer tower, or to a swivel-type stocking-out chute. A bulldozer moves coal to the stock pile. When needed the bulldozer moves it back to a reclaiming hopper at the track hopper house. An apron feeder then moves it to the crusher inlet from where it can either pass through or around the crusher to the gravity-discharge elevator.

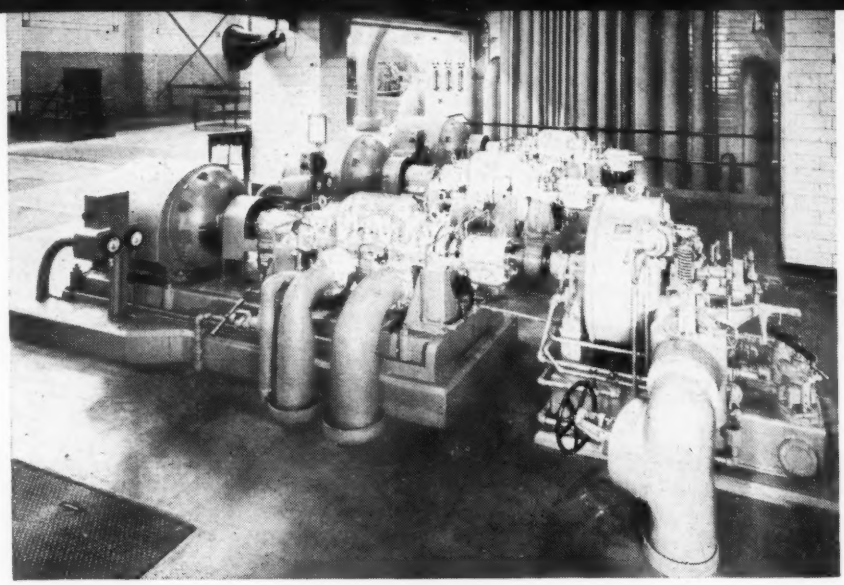
Coal delivered to the transfer tower discharges either to a second inclined belt carrying it to the new coal-bunker room, or to a reversible-flight conveyor delivering to the bunkers in the old section of the plant. This conveyor can be fed at the opposite end by two elevators in the existing plant, during repair of the gravity-discharge elevator. Flight conveyor, when operated in reverse, discharges at the transfer tower to the inclined belt serving the new bunker room. Coal entering the new bunker room discharges to a short horizontal belt conveyor, which feeds a reversible shuttle belt conveyor. This distributes the coal through a rubber bunker seal to the new bunkers.



3000-KW TURBINE-GENERATOR takes high-pressure steam and exhausts it to main in existing 325-psig station. Exhaust helps develop full output of 1-p turbines



CONSTANT-PRESSURE DEAERATOR receives steam from three sources, the output of one evaporator, 10th turbine stage at light loads, 14th stage during heavy loads



ONE DUAL-DRIVEN AND TWO MOTOR-DRIVEN feedwater pumps for the high-pressure boilers are located on the main turbine-room floor level near backpressure unit

Coal leaving the bunkers passes through two feeders per boiler to its respective Hardinge pulverizers and exhausters to the burners. Each boiler has six burners horizontally opposed, three in front and three in rear of each furnace. This type firing was selected on the basis of results at the Gilbert, West Reading and Westover Stations, which indicated the effectiveness of opposed firing in lowering carbon losses in the flyash. New furnaces at Crawford are provided with overfire air nozzles so this feature may be added at a later date if considered necessary to improve operation.

Hydraulic jets remove ash from the boiler ash hoppers, the ash then sluices to a clinker grinder mounted over an ash sump.

A vacuum system, which collects soot from the chimney base and precipitator hoppers, mixes it with water when passing through an ejector immediately preceding the ash sump. Soot from the last passes of the boilers flows by gravity to the ash hoppers.

Either of two rubber-lined centrifugal pumps passes the ash and soot from the ash sump to a settling basin adjacent to the station.

Plant Makeup. Water for makeup flows from the Susquehanna River through a mechanical trash rake and traveling screen, and is chlorinated. The water is then pumped to a Spaulding precipitator where chemical coagulation and clarification are effected by aluminum sulphate and soda ash. Following this process gravity-type filters complete the mechanical filtering. From the filtered-water clear well, pumps pass water through fully automatic zeolite softeners to a deaerating-type evaporator preheater. Part of the vapor from the No. 2 evaporator heats water in the tray-type deaerating preheater.

Makeup water flows by gravity from the evaporator preheater to the shells of two evaporators. One receives its heating steam from the 10th-stage bleed and discharges all its vapor to the deaerators in the old plant. The second evaporator, No. 2, takes its steam from either the 10th- or 14th-stage bleed, depending on the load the turbine carries. Part of the vapor goes to the evaporator preheater for heating as mentioned, and the remainder flows to the new deaerating heater where it joins the cycle feedwater.

Continuous blowdown lines maintain boiler-drum concentration at a level not exceeding 500 ppm.

Cooling Water. Circulating water from the Susquehanna enters an intake channel with its mouth slightly downstream from the screen houses. This forces the water to make a turn of about 130 degrees when leaving the river, in this manner keeping a large percentage of the large pieces of floating debris and ice cakes from entering the channel. A bypass channel with an adjustable weir connects the discharge channel with the mouth of the intake channel. The weir level is lowered during periods when needle ice forms in the river. This recirculation has proved very successful in minimizing difficulties encountered from ice in the intake channel and in the screen houses.

A mechanical trash rake clears the trash rack, composed of wrought iron bars on 4-in. centers, during floods or when the river is filled with leaves during the fall of the year.

After passing through the trash rack, water flows through two traveling screens. These screens have segregating sluice gates so either screen well may be pumped out and the screen repaired without use of stop logs and without interfering with operation of the other screen. Each screen has a screen-wash pump and a differential-pressure switch. The latter automatically starts the proper screen-washing pump when the water-pressure drop across the screen exceeds 2 in. of water. The pump builds up pressure and provides a cleaning spray for the screen. A pressure switch connected to the spray line automatically starts the screen rotating. A time-delay relay prevents the pump from stopping before the screen has made at least one complete revolution during an operation.

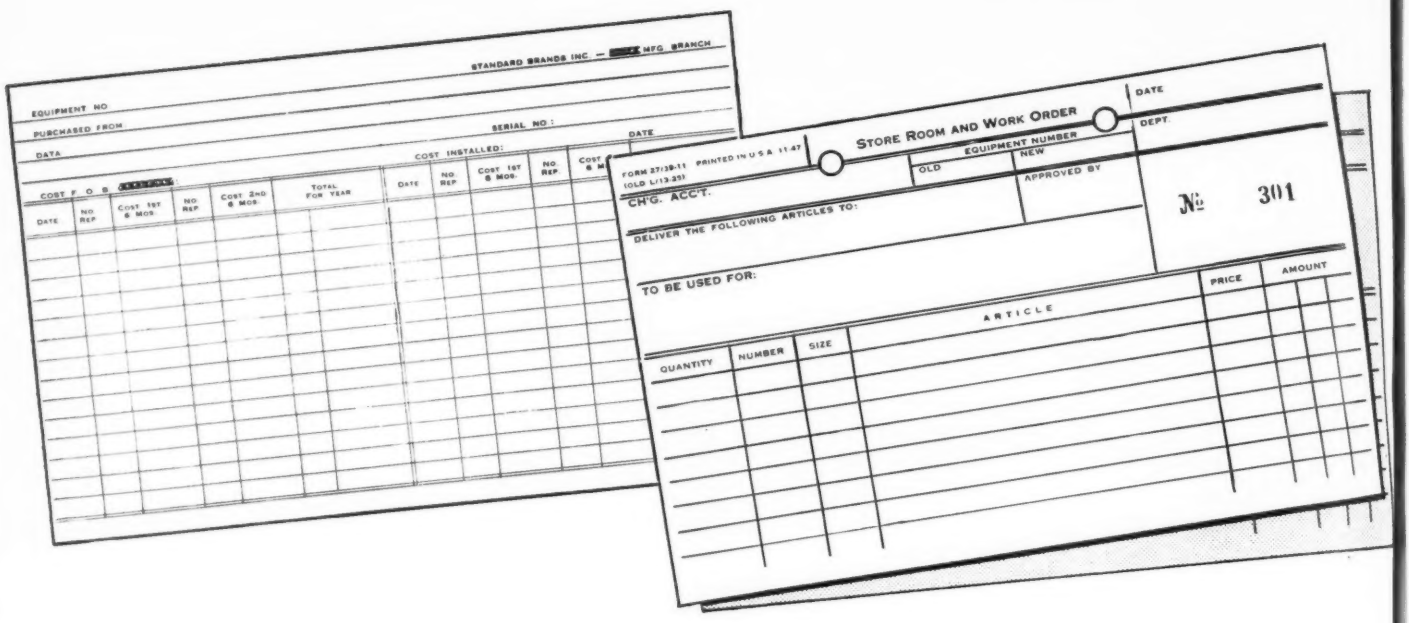
Intermittent chlorination of the water leaving the screens prevents organic growth in the tunnels, pumps and condenser. Water flows through two horizontal centrifugal circulating pumps to two MacNeill reversing valves, and then proceeds through the 2-pass surface condenser, which is equipped with internally bronze-sprayed welded-steel divided water boxes, to the discharge tunnel, and over a sealing-chamber weir to the river.

The MacNeill reversing valves, which are motor operated, allow the condenser to be backwashed without interfering with normal operation.

Summary. Crawford Station was designed for reliable, troublefree, efficient operation at reasonable cost. It was necessary to balance these items against each other; reliability and low maintenance were given primary consideration. This procedure was responsible for the decisions to (1) equip all closed feedwater heaters with drain cooler sections to minimize flashing of heater drips and resulting higher maintenance (2) select closed heaters in place of open (3) select 94% efficient precipitators to minimize i-d fan erosion and smoke nuisance (4) select a coal-handling system that serves the entire plant and can be fed by two independent sets of elevators (5) select a makeup system that provides distilled makeup for the old plant as well as the new, since the cycles will be interconnected.

This station lays no claim to the lowest heat rate on record, nor to the lowest cost per kw installed capacity, but engineers and operators will consider the project well worthwhile if it proves reliable in operation, requires a minimum of maintenance, is simple to operate at reasonable cost.

Continued on page 95



1 Each individual piece of equipment requires a separate number and a card with all identifying maintenance data

2 Once class of maintenance work, electrical, mechanical, etc, is fixed, a work order form like this one is issued

Preventive Maintenance Requires Firm

► PREVENTIVE MAINTENANCE in an industrial plant (1) reduces unscheduled outages (2) establishes engineering control on production equipment and (3) simplifies appraisal and auditing studies.

How do you go about setting up a preventive maintenance program in a typical plant? An industrial plant may have any number of major departments —for instance, power generation, fermentation, grain preparation, or whatever the major processes run.

Preliminary Steps. First step in establishing preventive maintenance is to make up an equipment book. This book identifies every piece of equipment that you intend to cover in your maintenance program. The identification, preferably by number, should cover location, class of service, type of equipment, serial number and capacity.

The assigned equipment number ties down location quickly and unmistakably. For instance, number 15-067-2 means that in building 15, a certain piece of equipment is number 67, and is on the 2nd floor.

Let's add to this some engineering information. The plant engineer and master mechanic review each piece of equipment, studying particularly operating life, trouble experiences, service load: Is it on 24-hr operation? Has it been breaking down often? What has been the nature of the break-down?

With this data, group the equipment into categories. These categories can be set up on the basis of function, class of service, or any other criteria that help in determining frequency of inspection or scheduled shutdowns.

Inspections for the first six months to a year of a preventive maintenance program must be kept fluid. At first, frequency of inspection depends upon the judgment of plant engineer, master mechanic or foreman close to operation. Once a record-keeping system begins to accumulate the experience of operation, then changes take place. For example, as time goes by trouble pulls out a given piece of equipment for much more work than previous judgment had indicated, and so frequency of inspection increases.

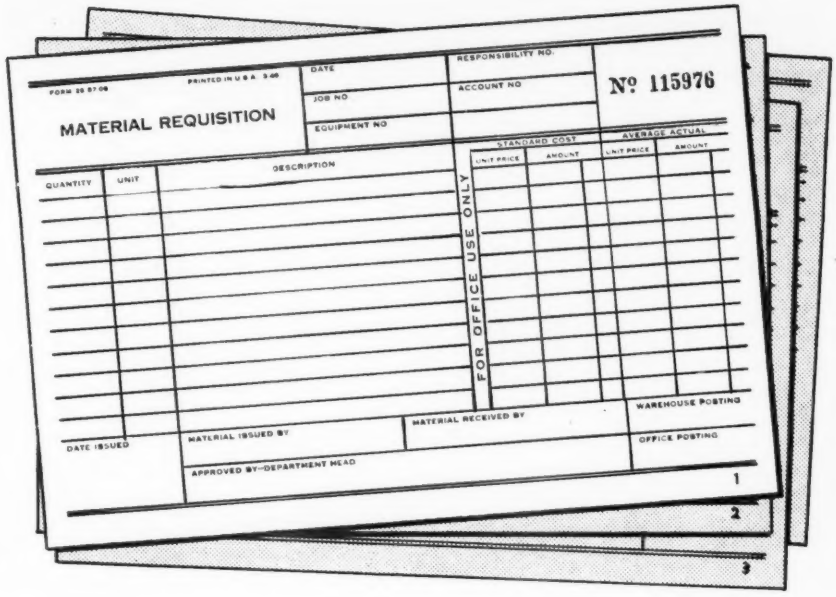
As a general rule, all equipment should be inspected a minimum of twice a year. More important, vital equipment operating continuously should be checked as often as once every month.

Program Takes Form. At this point a preventive-maintenance program begins to take form. There is now available (1) an equipment list (2) an estimated inspection schedule. On top of this, work out with the master mechanic a program to allocate the same volume of work for each month of the year. All pieces of equipment receive scheduled maintenance as the allocation program dictates.

The individual equipment card, Fig. 1, carries enough identifying data so the clerk handling records and scheduling knows what class of work is needed. A work order is issued to the electrical foreman, pipe fitter, operating foreman, or to someone in whatever craft keeps the equipment in working order. Work orders are shown in Fig. 2.

Procedure for compiling information from completed work orders is as follows: One order is sent to the storeroom, where it serves as authorization to issue material. A second copy stays in the engineering department for compiling labor and material charges. The third copy notifies the foreman to start work on the job.

3 Good operating men often see trouble coming, request unscheduled maintenance on this form



4 Material costs developing from a requested maintenance job or from a regularly scheduled one are collected and recorded for company use

Scheduling

Here are basic steps in setting up a preventive maintenance program in your plant. They pay operating and repair dividends, says O L Applegate, plant engineer, Fleischmann Mfg Div

Once a job is finished foreman marks order complete, maintenance clerk records information in a book, "Work Orders Completed." and computes labor cost. The storeroom clerk. also notified by the foreman, passes along material costs to (1) engineering dept and (2) accounting dept where they are entered against the job.

With this information, the plant engineer or master mechanic checks the work order and returns it to the maintenance clerk for filing and future use to check equipment maintenance costs. A total cost of repair and maintenance is compiled once a month.

When the plant engineer or master mechanic checks a work order he notes whether: (1) material runs high or low (2) only labor has been charged. He can tell from this if inspections are made often enough. With it he may decide to reschedule the preventive-maintenance procedure, subject to any later checks through operating experience or central engineering.

Unscheduled Maintenance. Over and above the repair and maintenance work growing out of a preventive program should be a system for unscheduled maintenance work. For instance, a good operating man can see trouble coming. To make it easy for such a man to set the wheels in motion and, incidentally, further develop this "sense of responsibility," Fig. 3 has been devised. The operating man notifies the foreman. points out the expected difficulty and Fig. 3 is filled out and submitted.

Now for the records: A material requisition form, Fig. 4, can be issued and all interested parties—general engineering. accounting, preventive-maintenance office—have the material costs developing from the requested maintenance job. But there is one more important step—an opportunity for management.

Once all facts and figures are in and enough information is at hand to fill in all spaces on Fig. 3 a real opportunity exists for management. That opportunity is to let the man issuing the original request—operating man or foreman—see the final costs. It gives him a feeling of belonging, an unquestioned asset in employer-employee relations.

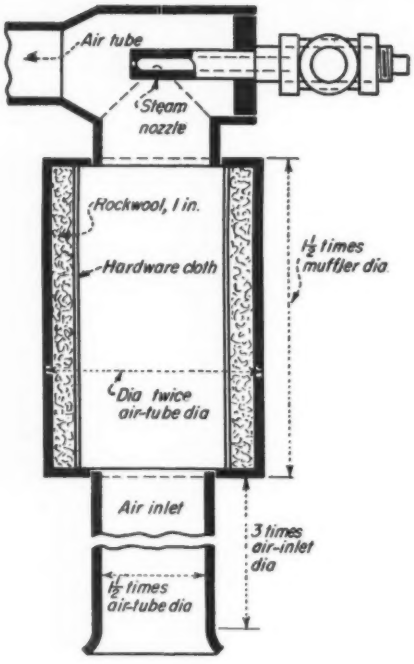
A series of steps, tied to each of the major points just discussed in connection with some of the details of office procedure, are as follows: Equipment-book entries involve a definite system. This book lists descriptive data on all equipment and has for each equipment entry a companion equipment index card. which lists cost of installation, estimated life, location, class of service.

Two events, which require special steps in handling the equipment book and the companion cards, are: (1) when new equipment arrives (2) when old equipment is transferred or scrapped. Special forms notify proper personnel of these changes and initiate (1) the necessary assigning or changing of numbers, locations: (2) issuing of work orders.

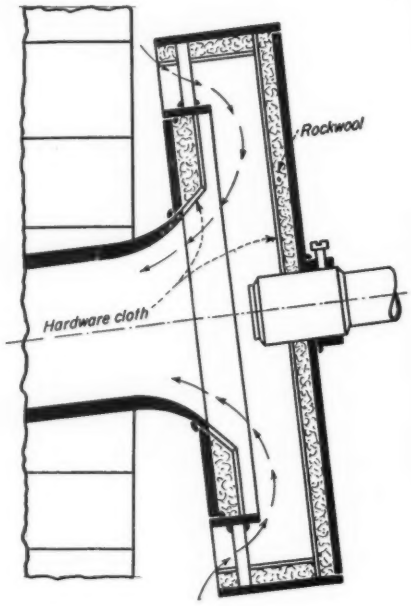
As for the other office details, such as tabulating costs, working out an exchange of information between accounting, stores and engineering departments, they vary with the individual plant and its practices.

A firmly scheduled preventive-maintenance program pays dividends in (1) better operation (2) closer control through first-hand information founded on recorded experiences (3) over-all reduction of maintenance costs.

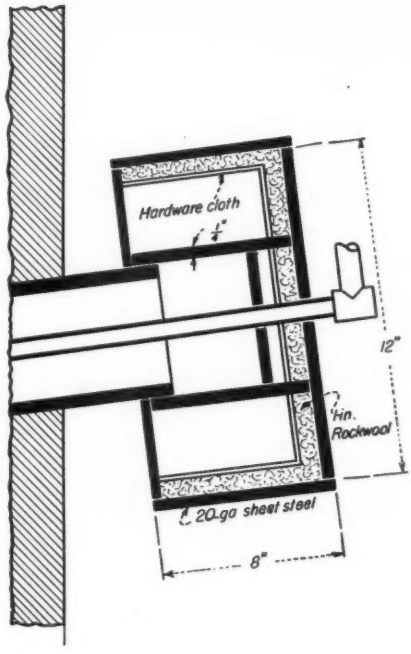
Equipping Overfire Jets With Mufflers Makes Them Silent Working



1 Pulling air directly from a boiler-room produces an irritating noise



2 Mufflers lined with a soft and sound-absorbing surface will cut down noises



3 Making sure that the air passages are large assures unrestricted air flow

Cut Smoke by Proper Jet

When you fire coal on a fuel bed by spreaders, underfeeds, chain or traveling grates you get best combustion efficiency in furnaces designed for the firing method. Once you change your firing method your furnace may need the help of overfire jets. Here's the latest data on loca.ing and applying them

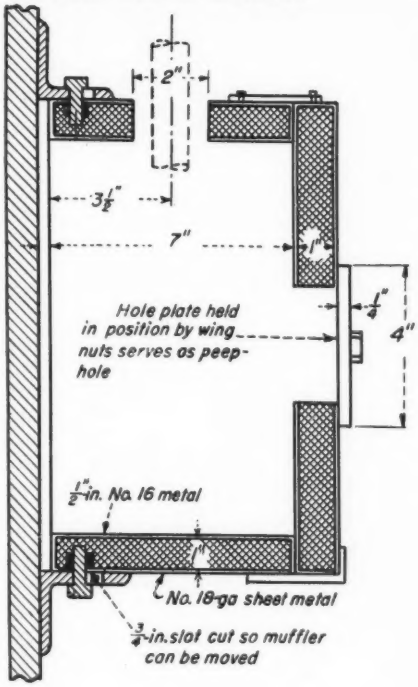
OVERFIRE JETS as smoke-reducing tools have strong appeal for owners of boilers that are already operating. In September (pp 78-81) we discussed design of these jets. Here we get down to cases and talk about their effective application.

But before we get into actual applications let's stress again certain precautions, mentioned in September, that must be taken to make an installation successful. Unless a given boiler-unit requires continuous operation of jets that unit has to have either reliable automatic jet controls, preferably electronic, or a convenient indication for acquainting the fireman with the density of flue gas. No fireman will, or could be expected to, operate jets only as they are needed.

Once the decision to use jets has been made, steps must be taken to work them into the boiler room without creating unlooked-for problems. For example, an unmuffled steam jet delivering air from a boiler room produces a highly irritating noise. Several jet mufflers have been developed to correct this nuisance, Fig. 1-4.

Sample Muffler Designs. Fairly simple arrangements give as effective a muffling action as the normal boiler room requires. Soft surfaces for the inner lining of mufflers absorb irritating sound waves and reduce the objectionable noise level. In addition, ample passages through the muffler or silencer permit unrestricted air flow. Some installations employ a large duct leading

Tools on a Boiler



4 Removable muffler assembly makes jet-maintenance an easy-to-do job

Application

By L N ROWLEY
Managing Editor

and

J C McCABE
Associate Editor

from a remote corner or an air preheater to supply the jet. Air admission from such an out-of-the-way source cuts down the audible sound-level produced by air pulled into the jets.

Special jet applications, though, impose their own problems on muffler design. The only workable muffler for bridgewall mounting, for instance, seems to be a special manifold for steam distribution with steam nozzles carefully spaced, and accurately centered and positioned with a regard to the retorts. But such a jet location suffers from (1) difficulty of accurate mounting (2) high furnace-wall temperature in this zone (3) inaccessibility for jet cleaning.

This last item—jet cleaning—brings up the importance of good maintenance in getting top performance from jet and muffler assemblies. One large user of overfire jets has developed a set of recommendations that serve as a guide to jet and muffler designs. He recommends: Where single mufflers, Fig. 4, have been installed make muffler top removable so access to jets and air tubes is facilitated.

Where nozzles must follow close spacing use one continuous muffler. But allow access holes for each jet, as in Fig. 4.

Put an outward bevel on all nozzle tips. The bevel space permits mill scale to fall away from the orifice. This built-in cleaning action reduces the possibility of nozzles plugging up.

Make air-tube tips on the fire end out of a high-temperature metal, such as is used for soot-blower elements. Sections of Dialoy soot-blower elements, 6 in. long, work out well. Such a metal makes it possible to project the air tube slightly into the furnace. This projection cuts down the likelihood of slag covering the tube end. In addition, the high-temperature metal gives longer maintenance-free operation.

Jet Location. Unfortunately, few definite rules or guides exist for selecting proper jet location. A number of typical installations, Fig. 5-9, point up this fact. Some arrangements cover the full firebox quite well. Others are designed to meet and correct only a localized smoking condition, Fig. 9.

One technique advanced for spotting jets involves use of a bare steam nozzle attached to a steam hose. With this setup, explore the firebox from as many openings as available. A close observation of location and effect that the bare steam nozzle produces on furnace smokiness helps to determine location of permanent jets. Most effective location will indicate furnace wall and approximate jet elevation above the fuel bed to produce best smoke elimination.

Traveling Grates. Usual application of jets to traveling-grate stokers follows the theory of rear-wall mounting, Fig. 6. The jets, it is felt, force the lean-furnace-gas mixture (heavy in air, light in hydrocarbons) characteristic of the rear portion of the grate into intimate contact with the rich, heavy hydrocarbon streams rising near the front wall or ignition region of the grate.

A more direct and reportedly highly effective application of jets to traveling grates makes use of the front wall. In this application, primary-air supply to the rear of the grate must be controlled to its lowest possible flow. Jets in the front wall supply a controlled amount of air directly to the hydrocarbon strata coming off the front of the grate. This gives a high degree of turbulence between air and furnace gas. It achieves the necessary intimate mixing between the volatiles released and the air.

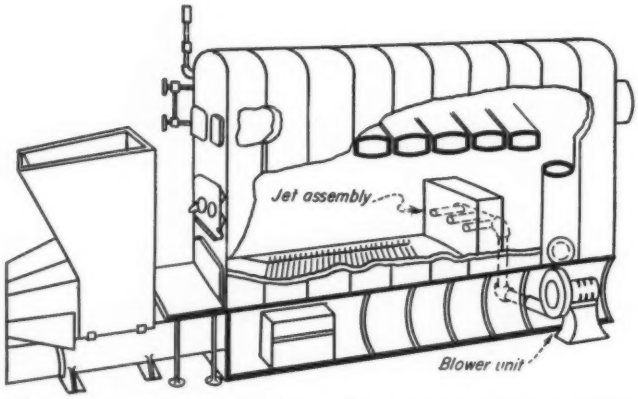
Spreader Stokers. Front, back or side-wall locations give equal effectiveness with spreader stokers. Jets should introduce air not less than 18-24 in. above fuel-bed top. Since spreader stokers liberate hydrocarbons from coal particles in suspension, rather than from the fuel bed, a higher secondary air stream must be used to set up turbulence with the hydrocarbons. Jets, with velocities as recommended in the September issue, have little effect on coal distribution over the fuel bed even when directed into the coal stream leaving the spreader-stoker distributor itself.

To date no jet arrangement completely combats flyash carryover from spreader-stoker firing. Some reduction, in flyash emitted, results if jets are placed high enough to catch up suspended particles before they are swept up into the furnace passes.

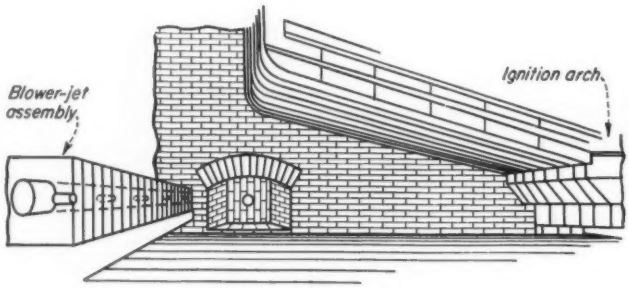
Underfeed Stokers. Single- and twin-retort underfeed stokers (May 1948, pp 84-87) put out little or no smoke when: (1) installation is according to recommendations (2) operation proceeds with average caution (3) fuel bed is not manually disrupted. Where smoke troubles do develop a 35% overfire air, properly directed, gives excellent results. Jet location follows usual pattern outlined below under installations.

Multiple-retort stokers serve bigger furnaces and require somewhat more precise spotting of jets. Customary installation locates jets in the front wall, Fig. 7, with spacing adjusted to coincide with retort spacing. Each jet, then, discharges into the region directly above a retort where a reducing atmosphere frequently exists. Often jet penetration need only reach the length of the "hump" characteristic of underfeed-stoker fuel beds. Beyond this distance a better balance between combustibles and air reduces smoke troubles.

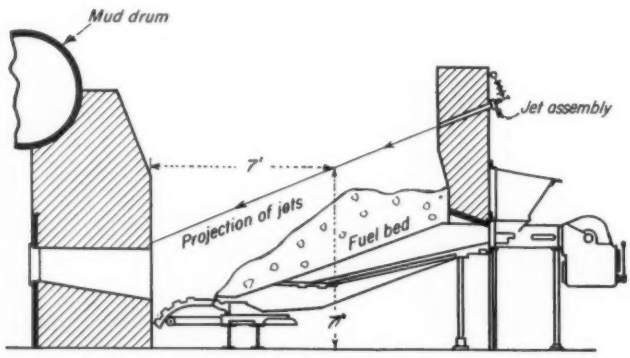
Specific Installations. A cast-iron sectional boiler usually requires a bridgewall mounting. Fig. 5 shows just such an installation as recommended by the Chicago Dept of Smoke Inspection and



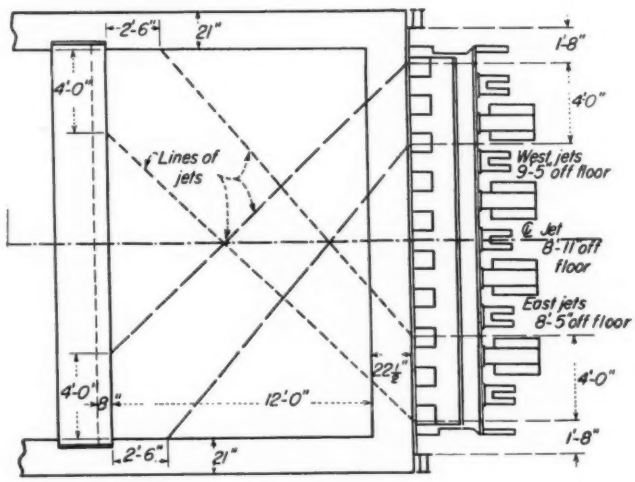
5 Bridgewall mounting above the fuel bed seems most practical for location of jets in sectional cast iron boilers



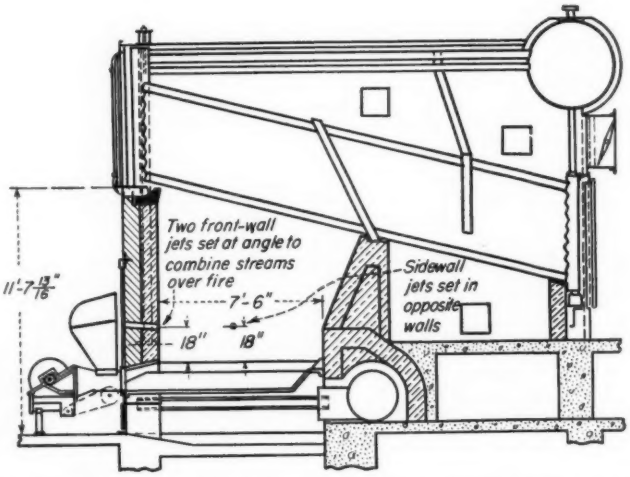
6 Front- or rear-wall mounting works with traveling grates. Rear jets, above, direct air into rich gas stream up front



7 Multiple retort stokers employ jets mounted in front wall and spotted to coincide with the individual retort spacing



8 Jet arrangements and angle of stream can be made to cover the full firebox or correct a localized smoking condition



9 Underfeed stokers often require jet penetration only the length of the fuel hump to cover the oxygen-short area

Abatement. A blower must be used to get necessary penetration.

One large utility running several power plants equipped 29 underfeed stoker-fired steam generators with various forms of overfire air jets. Its practice placed steam-actuated jets on all older boilers where (1) a limited operating life is foreseen (2) loss of steam imposes no makeup hardships.

In one setup, Fig. 7, four jets per boiler produced a definite improvement in smoke emission from 12 operating units. Six additional jets per boiler are going in to provide for overload conditions.

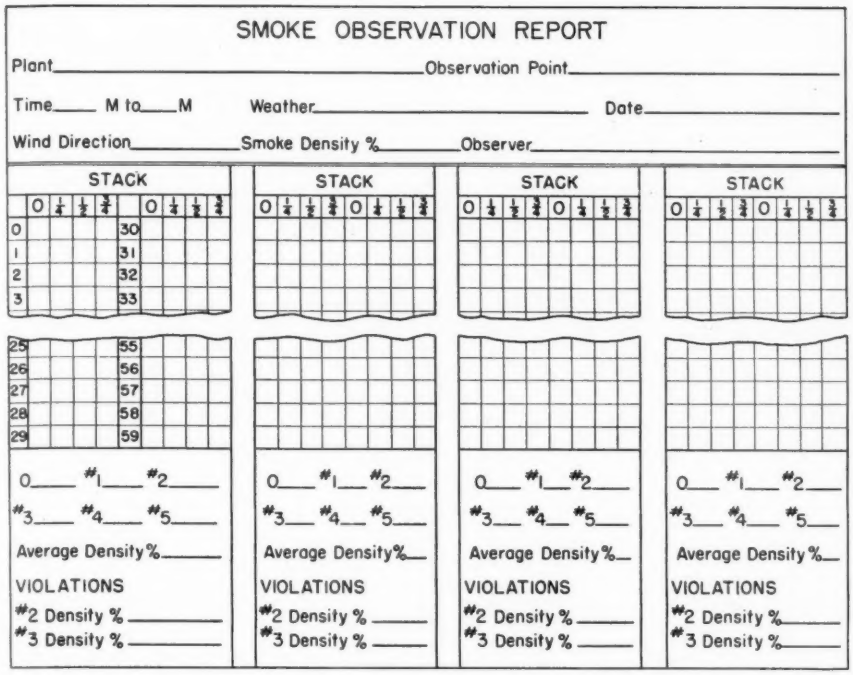
Another boiler-type at this same plant has five jets per boiler. These boiler-units have high settings and smoke difficulties have never been excessive. The jets were added to take care of peaks over and above the expected normal.

At still another plant 12 underfeed units operate with only two pairs of jets, set to give a diagonal throw, Fig. 8. To put in additional jets along the front wall meant a very expensive installation. Results have exceeded expectations and no more jets are planned.

One plant experienced makeup difficulties from a use of steam-actuated jets. They went to a blower-jet form of introducing overfire air. Fifteen ½-in. jets went into the front wall and twenty 1-in. jets into the rear. Fan pressure runs 30 in. wg. From a smoke standpoint the installation gives satisfactory results. But for efficiency considerations, the large air volume entering at the back wall has an adverse effect.

The next blower jet arrangement planned by this company gets around this objection by leaving out all rear-wall jets and putting in nine 1½-in. jets in the front wall to operate under a 20-in. wg fan pressure.

A municipal system reports a set of thirteen 1⅛-in. venturi tube nozzles machined from cast-iron operating on two 150,000-lb-per-hr, 425-psi, 700-F underfeed-stoker-fired steam generators.



10 Actual jet performance can be determined only by setting up regular procedure for taking smoke observations. Above form enables observation of four stacks

Table I—Figures on Several Plants Under Observation

Plant	Stacks	Observations	Smoke density, %	Ringlemann, % No. 2	Ringlemann, % No. 3	Jets
Sta 1.....	1, 2, 3, 5, 6, 7, 8...	139	24.6	31.4	11.3	None
Sta 1.....	4.....	11	5.3	3.0	0.0	Blower
Sta 2.....	1 and 2.....	57	24.9	24.9	1.3	None
Sta 3.....	North.....	32	15.2	3.7	0.0	Steam
Sta 4.....	A, B.....	68	20.0	17.4	3.3	Steam
Sta 4.....	C.....	34	9.7	6.7	0.6	Steam

Table II—Readings Collected From 48-Hour Test
Blower jets were turned on and off alternately every half hour

	With jets	Without jets		With jets	Without jets
Smoke density, %....	7.0	32.7	Steam, lb per hr.....	97.400	96.200
Ringlemann No. 2, %.	0.0	51.2	Outlet-gas temp, F....	789	788
Ringlemann No. 3, %.	0.0	12.2	Boiler outlet, CO_2, %.	11.9	12.6

These jets use a blower rated at 6000 cfm with a static pressure of 14-in wg. Actual operating conditions require only 1250 cfm at 10 in. to get a penetration length of 8 ft plus.

Center line of the nozzles stands 5 ft 9 in. above the top line of tuyeres at the furnace front. Nozzles aim at a point 3 ft 2½ in. above the bottom line of the tuyeres at the furnace rear. Center nozzle is 8 ft 11 in. from side waterwall edges. Nozzle spacing is 12 in., center to center, and outboard nozzles mount 1 ft 11 in. from side waterwalls.

Cost of Jets. How about relative installation costs of blower jet against steam jet? Only comparison available places steam jets at present-day prices, including engineering and overhead items, to run between $80 and $110 per jet. Blower-jet assemblies available range from $194 for set of 4¾-in. nozzles to $925 for 16 of 2½ in.

Now for some field experience on re-results. The municipal job described above is felt by the plant operators to give a 2 to 4% improvement in boiler efficiency, considerably reduced soot deposit in the rear passes, a higher furnace temperature and a resulting lower flue-gas temperature. Jets operate continuously and no disturbing effect has been produced on the combustion control.

One organization, a strong believer in the value of overfire jets, has instituted a regular procedure of taking smoke observations. Each observation covers a full hour with readings every 15 seconds, a total of 240 readings per observation. Fig. 10 shows a form it worked up for recording observations from four stacks at one time. Table I gives an interesting set of collected figures on several plants under observation. At Station 1 eight identical boilers operate with separate stacks. One boiler, No. 4, put in blower jets for results shown.

Stacks under observation in Station 2 serve ten boilers. But most smoke offenses here occur during banking periods and it is felt that methods other than jets must be applied to improve smoke emission.

The North stack at Station 3 handles the output of 12 boilers equipped with diagonal jets. Usual smoke emission, before jet installations, ran between 40 and 60% density.

Twelve boilers with four jets per boiler discharge through two stacks, *A* and *B*, on Station 4. Six additional jets are going in each boiler to cut down on smoke emission.

The last listed series of data at Station 4 on stack *C* record the results of five diagonal jets per boiler added to three boilers whose output was fairly free of smoke before the jet installations. No marked improvement shows. This seems to indicate that jet-installations apply particularly where a heavy smoking condition prevails.

Table II lists the readings collected from a 48-hr test where blower jets were turned on and off alternately every half hour. Observations were taken for a total of eight hours.

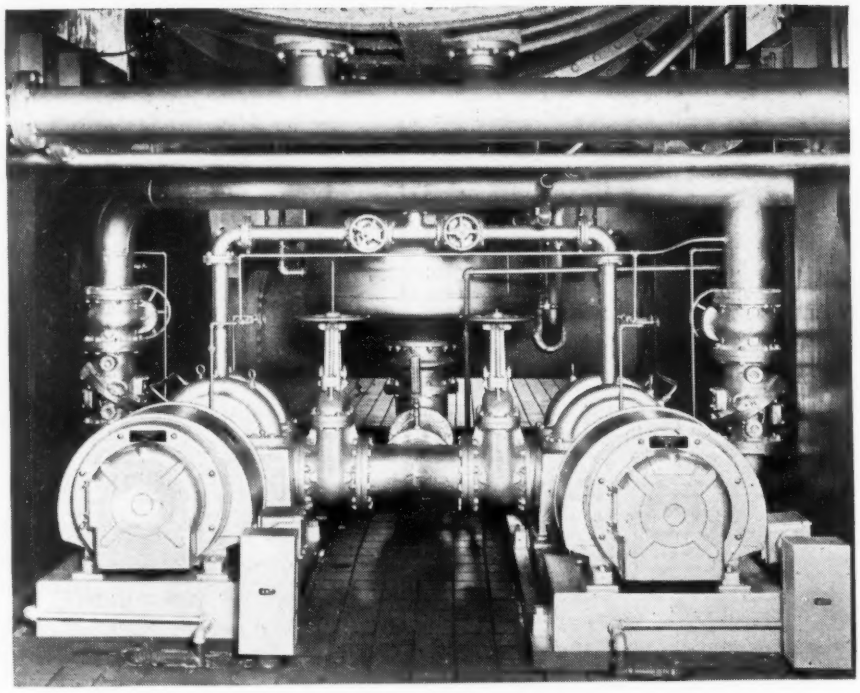
Blower-jet operation, judging from results recorded by this 48-hr test, cause a definite drop in CO_2 in the exit flue gas, possibly because additional excess air introduced over the fire (1) reduces percent of unburned combustibles (2) increases nitrogen and oxygen readings.

Operating the Jets. Smoke indicators are a must for helping the fireman decide whether jet action is needed. Most indicators suffer from a tendency of the lens to become dirty and give false readings. A dustproof box, covering both sending and receiving instruments, filters air drawn in around the instruments and keeps the lens clean.

For further practical information on applications, we refer you to the *Technical Report No. VII*, written by W S Major, of Bituminous Coal Research, Inc, and R B Engdahl, of Battelle Memorial Institute.

Here are the requirements for successful condensate-pump control by hotwell water level. Also given are the way pumps perform when their discharge is regulated by this means, as well as the advantages and disadvantages of control by submergence

By **PIO NARDONE**
Mechanical Engineer
Foster Wheeler Corp.



CONDENSATE-PUMP INSTALLATION. Two 2-stage centrifugal motor-driven condensate pumps are connected to the hotwell below the surface condenser serving a large steam turbine in a modern public-utility central-power generating plant

Suction Submergence Controls

► CONDENSATE PUMPS remove liquid from vessels under vacuum, such as steam-turbine condenser hotwells. Centrifugal pumps are generally used on these applications. Because of large load changes on the turbine, discharge rate of these pumps must be adjusted to maintain hotwell liquid level within safe operating limits. This can be done automatically by float or submergence control. The latter method is discussed in this article.

What Is Submergence? Submergence is generally considered as being the difference in elevation between the hotwell level and the pump's center line (horizontal unit). This head, however, represents only approximately the energy available to deliver liquid to the impeller eye, when the pump is near the hotwell and connected directly by oversize suction pipe. The true net positive suction head (npsh) at the pump's suction flange is the total available head (static plus velocity head) corrected to the impeller's center line above the vapor pressure at this point. Even though the term submergence, because of its popularity, is used hereafter, it should be borne in mind that npsh is the criterion for successful pump operation.

Centrifugal pumps, as generally built, have a rising head-capacity characteristic like Fig. 1. At constant speed, as the discharge decreases the total dynamic head developed by the pump increases. For example, in Fig. 1 at 375 gpm the pump develops 275-ft head, point *B*, where at zero discharge the head is 350 ft, point *A*.

On the other hand, the total head required to cause the liquid to flow through the system decreases as the volume decreases. Again, in Fig. 1 at point *C*, the system head at 400 gpm equals 258 ft. At 300 gpm, system head drops to 163 ft, point *D*.

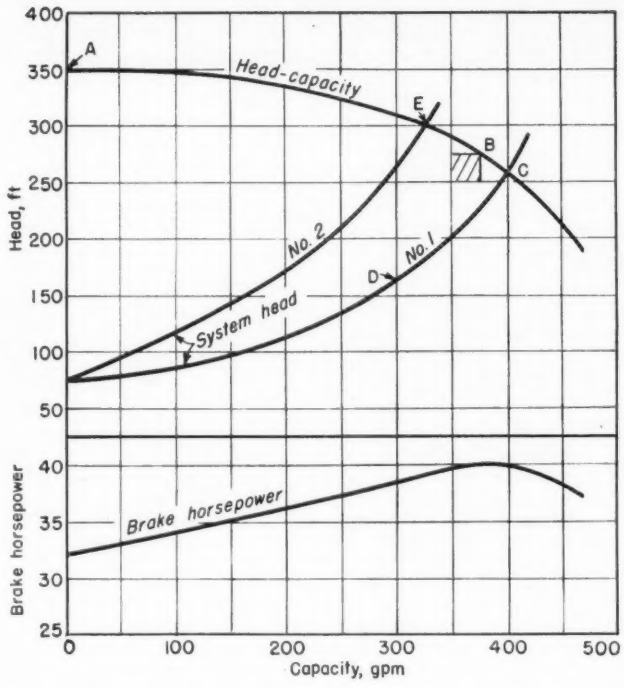
If flow from a centrifugal pump is not regulated there is only one condition where it will operate. This is the point where the system-head curve intersects the pump's head-capacity curve, point *C*, Fig. 1. At this point, head developed by the pump just overcomes the system resistance to the liquid delivered. At all lower capacities, head developed is greater than the system requires.

With many installations, it is necessary at times to change the rate at which liquid flows through the system, which can be done by throttling the pump's discharge. This artificially increases the system head so that it crosses the pump's head-capacity curve at a lower capacity, as is done with system-head curve 2, which crosses the head-capacity curve at *E*.

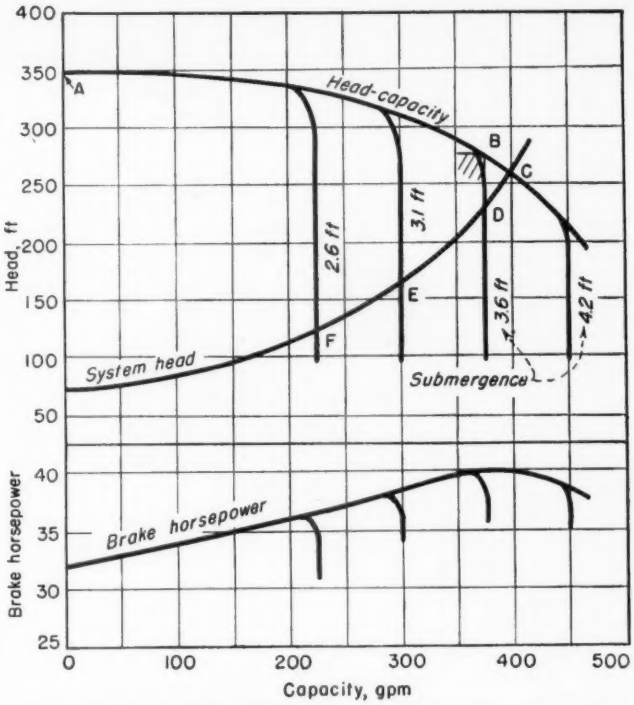
Capacity of the pump can also be reduced by bypassing some of the liquid discharged by it back to the suction. For condensate service we may use another method, known as submergence control—that is, control by the liquid level in the hotwell.

Submergence Control Operation. For successful operation of this control with a centrifugal pump a given submergence is required to cause a given quantity of liquid to enter the impeller. At this submergence the pump can deliver no more than this quantity.

At a given submergence and capacity the head developed by the pump decreases sharply because of partial evaporation of the liquid at the impeller eye. Point at which this drop in head occurs is known as the break. The head developed by the pump decreases



1 CHARACTERISTIC CURVES. Head-capacity, system-head and brake-horsepower curves for a centrifugal condensate pump. When pump discharge is decreased, its head increases



2 EFFECTS OF SUBMERGENCE. Head-capacity, system-head and brake-horsepower curves for a condensate pump which show how suction submergence determines discharge rate

Condensate-Pump Discharge

until it equals the system head at this capacity. Fig. 2 shows the characteristic curves for a pump with only a few break points indicated. There are, however, an infinite number of these points at which the pump can operate.

For a pump to operate properly with submergence control, it must be selected so the base head-capacity curve intersects the system-head curve at some capacity, point *C*, beyond the maximum flow desired, point *B*. If submergence at a desired maximum flow were sufficient, total head developed by the pump would be greater than the system head. The unit must be selected so maximum submergence available is greater than the submergence for operation at required capacity. Operation will be as follows:

Pump Operation. If a maximum flow of 375 gpm, point *B*, comes into the hotwell from the condenser and the submergence is 4.2 ft, the pump will operate at about 400 gpm, point *C*. Thus, the pump removes more water from the hotwell than the condenser adds to it. Hotwell level is lowered until the submergence is equal to 3.6 ft. At this submergence the pump becomes stabilized and operates at point *D*. This is the point where the head-capacity curve (in the break region) crosses the system-head curve.

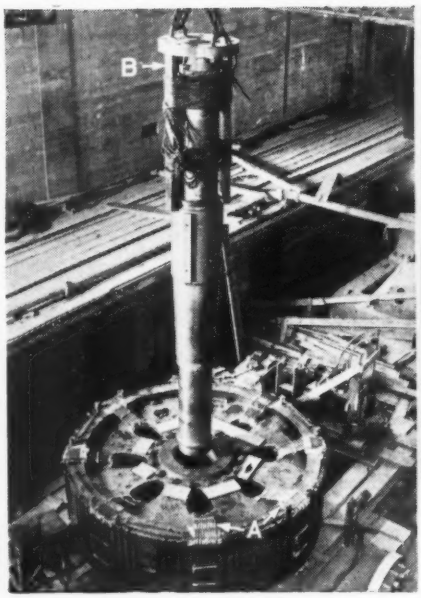
The pump then delivers just as much water as is added to the hotwell and the level remains constant. If the steam condensed decreases to where 300 gpm flows into the hotwell the pump temporarily continues to remove from it more water than is added until submergence decreases to 3.1 ft, when the two curves cross at *E*. The pump then becomes stabilized once more and the hotwell level remains constant at 3.1-ft submergence.

The reverse applies if the steam flow increases. Thus, stabilization takes place rapidly and for any steam flow to the condenser up to point *C*. At all times, therefore, the total head developed by the pump is equal to the system head and the pump delivers as much water as is added to the hotwell.

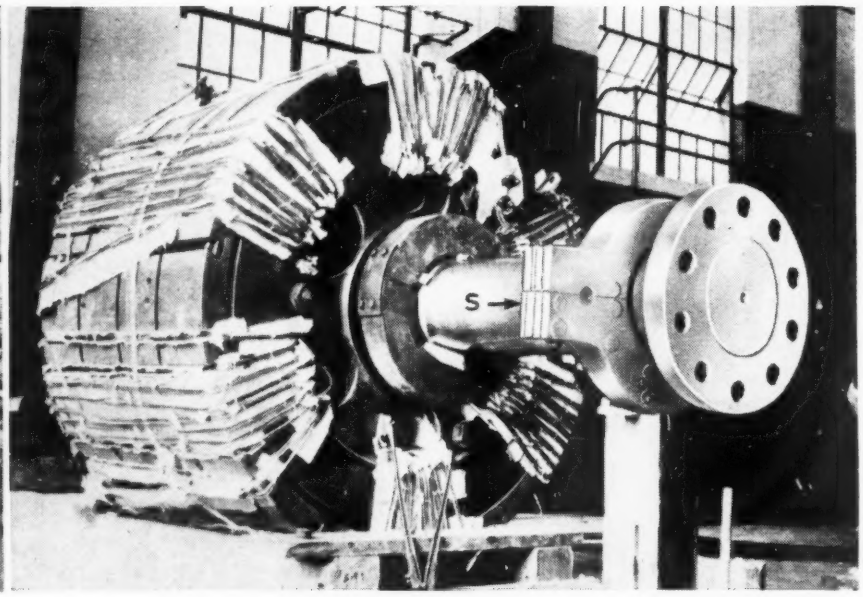
Note that a pump operating with submergence control always operates in the break regions or off the head-capacity curve. This is evidently so because the pump operates on the base curve only at point *C*, which is greater than the maximum flow, or if the submergence were artificially maintained, greater than the amount required for any particular flow. For the latter, some type of float control would be required and throttle or bypass control would be necessary.

Main disadvantage of submergence control is that some vaporization of the liquid always accompanies operation in the break regions. Because of the rise in pressure these vapor pockets or bubbles collapse as they flow through the impeller. This action is accompanied by noise and in time by pitting and corrosion of the impeller passages. Undue bearing wear may also result from varying shock loads imposed when cavitation occurs (pump operating in the break region).

But power for operating in the break regions will always be less than that required along the base head-capacity curve *ABC* since the total dynamic head that the pump develops is less than indicated on this curve. This decrease in power and the elimination of external controls are the chief merits of submergence control.



1 Setting shaft in cast-steel rotor's bore, expanded by induction heating



2 Horizontal-shaft assembly. Rotor made of four cast-steel sections had its rim heated to about 255 F by induction for removal from shaft, which was damaged

A Little Heat Eases Press-Fit Rotors on Their Shafts

Relatively small temperature increase may expand a large-rotor bore more than its press-fit tolerance. N L Rea, noted erection engineer, tells how to avoid trouble in the heating of these rotors for assembly on or removal from their shafts

► To COLD-PRESS-FIT a large flywheel or generator rotor on its shaft is a difficult and uncertain job. It is considerably simplified by heating the rotor or flywheel, and sometimes by cooling the shaft. Contrary to common belief, only a comparatively small increase in rotor temperature is needed for a sliding fit on a cold shaft. This temperature increase can be obtained by induction heating, electrical heaters, steam or hot water, as in the table.

Induction Heating. Temperature of 212 F will not damage even the lower-grade of electrical insulations, but will expand the bore of many rotor hubs to where they are larger than their shafts. Where a light press fit is required a rotor can be heated by induction so it slides on its shaft. For heavy press or shrink fits, induction heating materially reduces the work of pressing a rotor on its shaft. This method heats rapidly, is clean and easily applied. It is especially helpful when removing a rotor from its shaft.

Heating by induction is produced by electric currents induced in the rotor's outer surface, and not by resistance in the electrical conductors around the rim. It is therefore possible to heat and expand a rotor's rim and spider before the heat is conducted down into the shaft. We have obtained over 212-F rim-temperature rise before the heat reached the shaft. Expansion of the rim stretched the hub away from the shaft under these conditions.

Heating Winding. Fig. 1, shows the shaft being lowered into the bore of a cast-steel rotor expanded by induction heating. Heating was done by bare 250,000-cm cable, insulated from and wound around the rotor's rim between spokes and hub, as at *A*, and connected to a 60-cycle power source. Stop blocks *B* are lashed to the shaft to locate it correctly in the rotor hub.

All sections of the winding are wound in the same direction and connected in series to give them all the same polarity. This makes the rotor rim the equivalent of a single-turn secondary.

Experience proves there is no appreciable gain in putting the winding around the rim, Fig. 1 and 2, overwinding the cable on the rim's circumference. Also, insulated cable can be used because heating is caused by eddy-current and hysteresis losses in the iron, and not from resistance losses in the cable.

Electric-Oven Heating. Induction heat-

ing should not be applied to steel-plate rotors because the heat buckles and dishes the plates. Heat such rotors in a temporary oven of packing-case lumber lined with sheet iron or batters. Make the oven large enough to fit over the piece to be heated. In electric heaters 5- to 10-kw is enough to heat the largest rotor. Baffle the oven with sheet iron so the rotor is heated by air circulation and not direct radiation from the heaters. This insures uniform heating and avoids damaging the rotor by unequal heating in the different sections.

Checking Bore Expansion. Provide the heating oven with a small hatch so the bore's expansion can be checked without stopping the heating operation. Make a pin gage to fit the bore before starting the heating. Keep the gage lying on the shaft when not in use so it remains at shaft temperature. Check the bore's expansion with feelers between one end of the gage and bore.

Electric Heaters. Any available heaters can be used if applied intelligently. One large rotor was covered with tarpaulins and seven 750-watt lamps hung between the rotor's spokes several days. These provided enough heat to expand the rotor so it would slide easily onto the shaft.

If heaters are not available they can be made from iron telephone wire. Wind 100 turns on a ½-in. pipe mandrel. Slip the coil off the mandrel stretch to separate the turns and try it on 115 v. It should take about 10 amp and get nearly red hot. If it doesn't, shorten or lengthen the coil to get satisfactory temperatures and make additional coils like the sample. String porcelain knobs on iron rods or attach them to a strap-iron framework with insulators on stove bolts and connect enough coils in multiple to give required heater capacity.

Another method is to thread porcelain knobs on three concentric rings, Fig. 3. Here four 400-ft telephone wires in multiple on 115 v take about 35 kw. At frequent intervals tie the wires together and to the knobs.

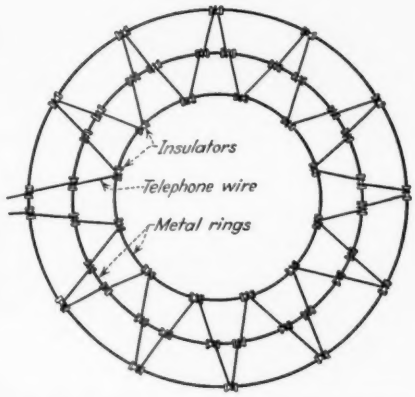
To use the heaters, support the rotor horizontally on blocking with the heaters placed 90 deg apart around it, with sheet-iron baffles between the two. Have the baffles extend vertically to top of rotor. Lower a square oven box over rotor and heaters, and natural air circulation will transfer the heat evenly to all parts of rotor.

A standard transformer drier that takes heated air from the bottom of the oven box and delivers it to the top has been used to advantage.

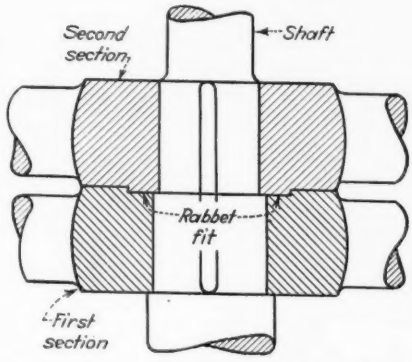
Vertical-Shaft Rotors. To assemble a vertical-shaft rotor, first up-end the shaft and bolt it to the dummy coupling plate in the assembly pit if the station has one, as it should. Otherwise, set the coupling in some convenient spot that carries weight of complete rotor, protecting the coupling face, and block the shaft securely, Fig. 5. Center the shaft as nearly vertical as conditions permit. Place stop blocks on the coupling to locate rotor on shaft correctly, if the latter does not have a shoulder for this purpose. It may require several hours for the rotor to cool enough to grip the shaft, so make sure it is supported in the correct location. One erector neglected to put stop blocks on the shaft and had to hold the rotor with the crane several hours before he dared slack off.

Adjust slings on the rotor's first section until it hangs level, then lower it over the shaft end far enough to center the bore on the shaft. Rotate the rotor to align key and keyway. Put match marks of white paint or chalk on end of crane and its track, and on crane carriage and girder where the crane man can see them. This saves time when lowering the hot section on the shaft.

Put the rotor with the slings on its support and place the heaters around it and heat until the bore has expanded the required amount. Place the thrust block in the oven so it will expand if it must be used as a strong back should the hot rotor hang up on the shaft. Arrange jacks and blocking for instant use. When bore has expanded, lubricate the shaft, lift off the oven box and quickly lower rotor over shaft.



3 Heater unit. Heater wire and insulators assembled on 3 concentric rings



4 Rabbet in hub. If hub has a rabbet, chip it out before starting assembly

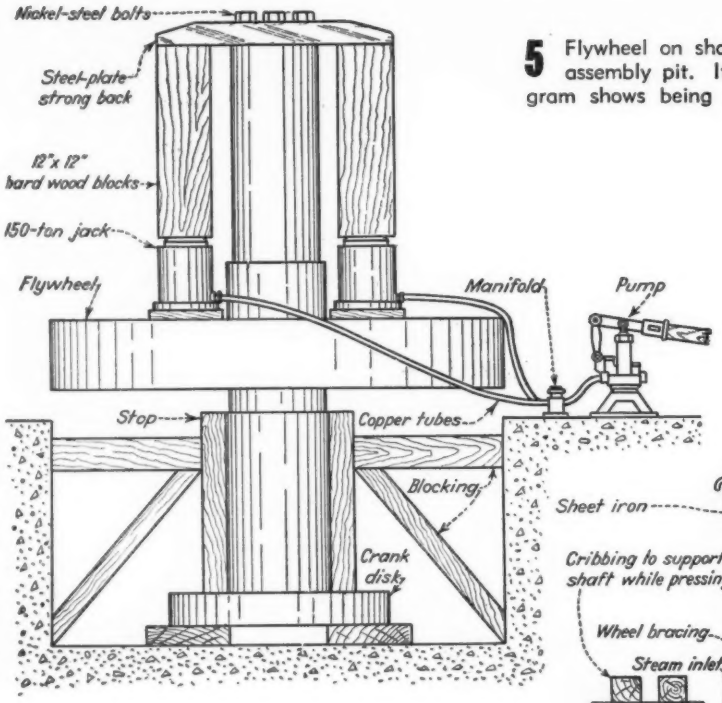
Heating the Rotor. Adjust the slings on next section and heat at least 24 hr, or until shaft and first section cool to room temperature.

Check hubs of all sections, which may have rabbet fits for manufacturing purposes. If rotor sections have a rabbet like Fig. 4, chip out the recess or cut off the spigot so clearance is ample to take care of expansion of the heated section. Shaft and keys locate and hold the rotor sections in correct relation so the rabbet fit serves no purpose after shop machining.

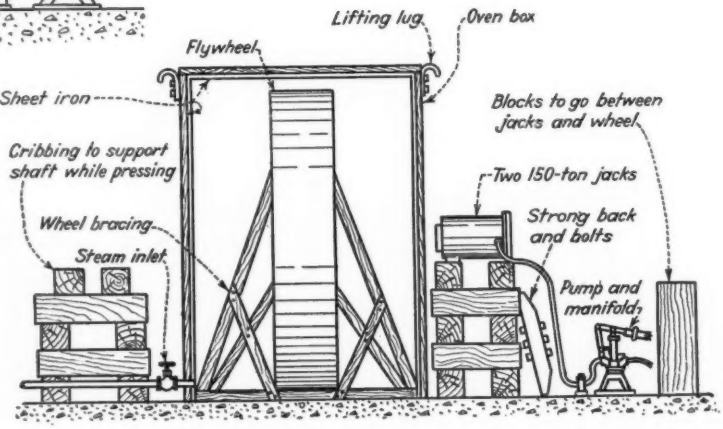
Rotor-Section Expansion. Remember that the rotor sections expand in length as well as in diameter. Weight of the first section holds it down against the shaft shoulder or stop blocks as it cools. The first section being cold chills the lower end of the next hub

Relatively Small Increase in Temperature of Rotor May Expand Its Bore More Than the Press-Fit Tolerance

Heating method	Bore dia, in.	Pressing allowance, in.	Bore expanded, in.	Oven temp, F	Room temp, F
Electric oven.....	20	0.005	0.040	356	86
Electric oven.....	18	0.012	0.030	275	68
Electric oven.....	20	0.005	0.032	248	68
Electric oven.....	40	0.017	0.035	257	77
Boiling water.....	24	0.015	0.023	212	68
Steam Box.....	24	0.017	0.022	212	68



5 Flywheel on shaft. The shaft is blocked in place in the assembly pit. It is ready for its flywheel which the diagram shows being forced into its place by hydraulic jacks



6 Steam-heating box is shown at lower left. A flywheel is blocked on edge in a steam box for heating. Everything is in readiness to press in its shaft at the right time

and causes it to grip the shaft so the sections will be solidly together. Never put two or more heated sections on a shaft at the same time. The outside faces of the sections hubs will grip the shaft and draw apart as they cool.

The keyways also expand so dummy keys must be driven into the pole key slots to hold them in alignment as sections cool. Three or four such keys, distributed around the circumference, are sufficient.

Horizontal-Shaft Rotors. When assembling a horizontal-shaft rotor, assemble the pressing rig and hold the section against the shaft shoulder or stop blocks until it has gripped the shaft. A flywheel or single-section rotor can be blocked on edge. Put the keyway on top, and heat either by electric heaters or steam. When heating is completed lift off the heater box and bring the shaft to the hot piece. Fig. 6 shows a flywheel in a steam box with the strong back, bolts, jacks and blocking ready for instant use if necessary.

Several of these assemblies have been completed by putting the shaft in with a chain block or using a timber as a battering ram. If a hub seizes before it is home it will be difficult if not impossible to get it either on or off. On the other hand when everything goes well, assembly is made quickly. A hot section has been lifted from the oven, placed on the shaft and the next cold section put in, in less than 15 min.

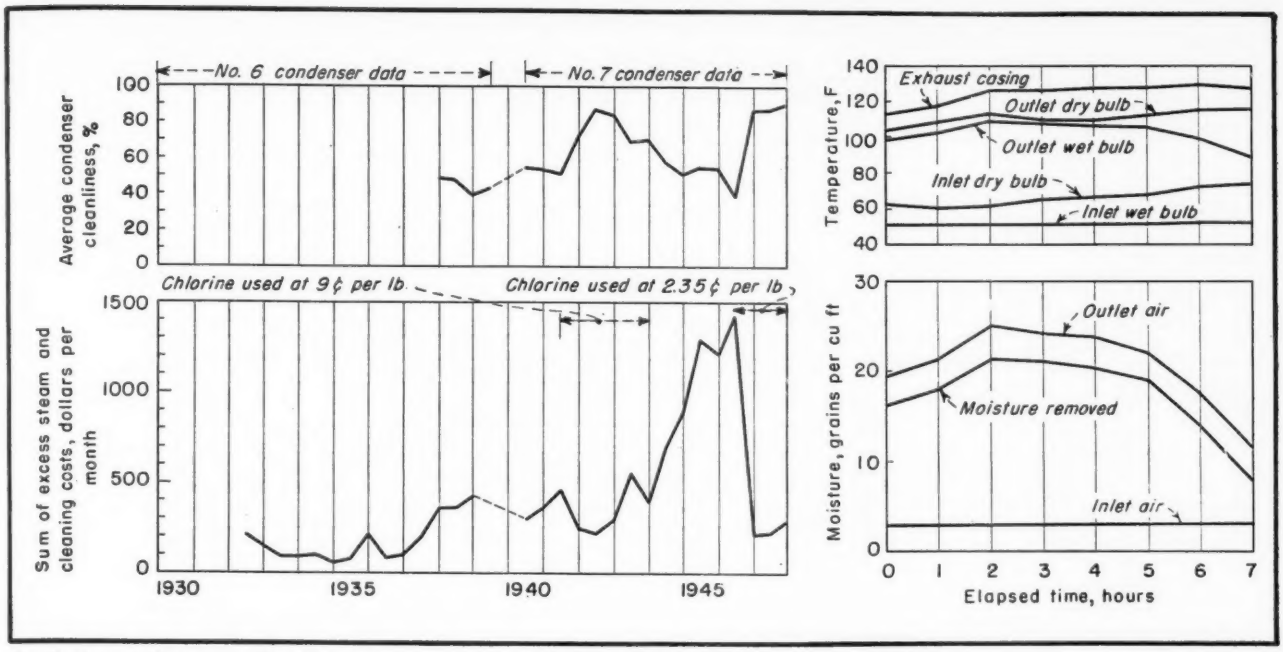
Removing Rotor From Shaft. It is sometimes necessary to remove a rotor from its shaft. It is foolhardy to attempt this without heating the rotor, cooling the shaft, or both. It may require three or more times more pull to start the rotor off than it took to put on the shaft. If the rotor was heated before putting on the shaft, the problem is more difficult than when a cold-press installation job was done.

Build a strong back of plates, described on p 69, June POWER, to fit against the hub of a forged coupling if the shaft has one or against the oil shedder of the bearing journal. Cut wood blocking and arrange to place the largest capacity jacks available between the strong back and the hub. Four 150-ton independent pump jacks with a common pump is not too large.

If the rotor has a cast rim and spokes, heat the rim by induction. If the rotor is laminated or has a winding, place electric heaters as near the circumference as possible. Raise temperature to around 180 F and at the same time, keep the shaft cooled with ice and salt, or dry ice if obtainable. Put full pull on the jacks and if rotor doesn't start, hold the pressure and bump end of shaft with a heavy timber or steel billet. A heavy blow often starts an obstinate rotor. Do not apply direct heat to the hub of a large rotor. The colder rim and spokes prevent expansion away from the shaft so the hub may grip the shaft harder than before heating.

Removing a Damaged Shaft. Fig. 2 shows a rotor, of four cast-steel sections, whose rim was heated to about 255 F by induction in about 2 hr while the hub's temperature increased to about 75 F with scarcely any increase in shaft temperature. After heating, four 150-ton jacks were used on the strong backs to remove the cast-steel rotor from its shaft, badly damaged by an accident in handling. The rotor started at 450-ton pressure and came off easily.

Against orders, not to try replacing the four sections on a new shaft at one time, the same winding was used to expand the rotor bore when installing the new shaft. The end sections bit first on the shaft. After that all lengthwise contraction of the metal occurred between the end sections. As a result there was a space between the sections around the through-bolt bosses when the rotor cooled. Special hand-fitted blocks had to be put between the sections to prevent springing the shaft when the through bolts were tightened.



1 During earlier years St. Johns River water was cleaner causing less condenser fouling. Coupled with the low oil cost, efficiency loss was not intolerable

2 Variation in wet and dry bulb reading measures moisture removal in drying

How Talleyrand's Condenser Operating Experience Varied Over the Years

Growing population and changing river conditions continuously posed new problems in keeping surface condensers clean. Increasing fuel costs made it imperative to find optimum means of reducing fouling with minimum hazard to station personnel

By T W BOSTWICK, J A CASSIDEY and J P HANCOCK*
City of Jacksonville, Florida

▶ TALLEYRAND GENERATING STATION, on the west bank of the St. Johns River in Jacksonville, was one of the first large steam-power plants built in Florida. From 6000 kw in 1913 the station has grown to a total capacity of 81,500 kw in five units today. An interesting phase of this growth is the development of operating and maintenance methods to control surface-condenser cleanliness.

Condensers. Table I lists principal data of the main condensers. No. 1, 4 and 5 have more surface per kw capacity than 6 and 7. This graphically illustrates the condenser manufacturer's contribution to the advancement of power plant design. Steam lanes give more effective surface use and, combined with more complete air removal, represent a relative saving in equipment cost.

Circulating Water. Average temperature of the St. Johns water has been 73 F for 20 years, with maximum and minimum yearly averages of 74 and 71 F. In contrast, the chemical and bacteriological content has varied markedly. Once the plant site is chosen, little can be done to change cooling-water type and character. The operating and development engineer must devise maintenance methods to cope with the ever-changing problem.

In the early 1930s the St. Johns River was relatively unpolluted. Jacksonville's population was then about 130,000; today it is above 235,000. The low chlorine demand of 3 ppm, bottom of table II, indicates the low pollution from raw sewage and industrial wastes. Water salinity as tested over a 20-year period shows a variation from 180 to 17,000 ppm sodium chloride. No trend has been found in this factor.

Stream pollution from all sources has been an ever-increasing problem. Trade waste from nearby industrial plants has multiplied the chlorine demand three to four times. Microscopic plant and animal life has changed in type and variety to survive and flourish under the latest conditions. Early difficulties were encountered with mussels, barnacles and heavy moss deposits in intake tunnels. Today slime-producing organ-

* Abstract of paper read before Florida Section ASME at April 1948 meeting of Florida Engineering Society

TABLE I—CONDENSERS OF THE TALLEYRAND GENERATING STATION

Unit No.	Date started	Make	Surface area, sq ft	Area, sq ft per kw	Pump capacity—gpm 1 pump	Pump capacity—gpm 2 pumps	Number of tubes	Tube length, ft	Water velocity in tubes, fpm—1 pump Inlet pass	Water velocity in tubes, fpm—1 pump Outlet pass	Water velocity in tubes, fpm—2 pumps Inlet pass	Water velocity in tubes, fpm—2 pumps Outlet pass
1	3–21	Wheeler	22,500	2.25	12,200	19,170	4156	20¼	2.67	3.20	4.20	5.03
4	6–18	Wheeler	11,000	2.75	12,200	.....	2385	18¼	4.67	5.56	....	....
5	9–21	Wheeler	22,500	1.80	15,000	23,550	4156	20¼	3.28	3.94	5.17	6.20
6	1–29	Wheeler	39,500	1.58	28,000	44,000	6874	22¼	3.89	4.20	6.10	6.60
7	3–39	Westinghouse	46,000	1.23	33,000	51,000	7950	22¼	4.29	4.32	6.43	6.47

All tubes are 1-in. diameter, No. 18 BWG

isms and industrial waste deposits are our problem. Microscopic examination of river water and slime shows the mixture containing fungi, an abundance of Crenothrix forms, dead mollusks, bacteria, bacterial zoogloea, filamentous algae, diatoms and Protozoa. A culture examination reveals large liquid bacteria colonies composed of small cocoid capsulated, gas-producing forms.

Checking Operation. Changing conditions led to early efforts to evaluate over-all heat transfer coefficients that we could apply to practical operation. In 1931 the first bogeys were established for expected operating vacuums for given loads, circulating-water quantities and temperatures, from the condenser contract guarantees. These then gave a basis for evaluating loss from condenser fouling, Fig. 1.

In 1936 we developed the cleanliness factor derived from the over-all heat-transfer coefficient. In making the formula an adequate working tool, effect of water-velocity changes through the tubes and of temperature were studied. Actual experimental data taken in 1937 on each condenser established the necessary correction factors.

Construction of unit No. 7 took most of 1938 and 39. In July 1940 the relation between heat transfer and water velocity was established. Cleanliness factor became a performance guide and practical working tool. By June 1941 all computations were standardized. The 100% cleanliness factor corresponds now to a corrected heat-transfer coefficient of 360 Btu per sq ft per hr per deg F. Much work can be eliminated in adopting this method if clean new tubes can be used to establish the bogey value of the coefficient.

Cleaning Methods. Cleanliness was not a serious problem immediately following installation of No. 6 unit. Pollution was relatively small and electric load was one-fourth what it is today. When condensers did foul with slime, moss and mussels it was no particular trouble or expense to shut down the unit for cleaning. Steam costs were about 15c per 1000 lb with fuel oil at 68c per bbl. Loss in vacuum was about $3.50 per day for each 1/10th inch excess backpressure on No. 6.

Rubber plugs, blown through with compressed air, scraped off slime from tube interiors. Condenser cleaning cost about $60 per unit; a rough method prorating condenser cost over the number of service days was used to judge when to clean.

Throughout 1932-4 the increasingly ineffective cleaning by rubber plugs was carried on. Men worked hours in a disease-laden atmosphere shooting the plugs through tubes. Fig. 3 shows this method left appreciable amounts of fouling in tubes. Dissatisfaction led to searching for more effective methods.

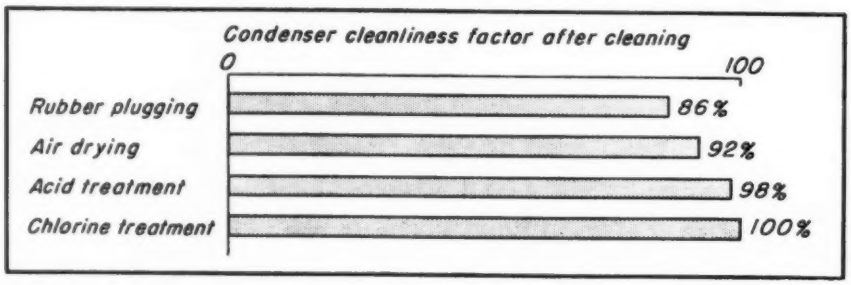
Observation of condensers, opened to atmosphere two to three weeks, showed mud and slime curling and cracking off the surface as they dried. When placed back in service the water washed out the dried scale and the vacuum was improved.

To speed nature's cleaning method, experimentation with air drying was started on No. 1 in July 1934. Two electric heaters of 3 kw each were placed at the discharge of a small 500-cfm ventilating blower. It took 147 hr to complete the job. Air leaving the condenser barely reached 100 F. Wet and dry bulb reading of inlet and outlet air showed 2520 lb moisture had been removed.

As in all development work, valuable and useful information was gained from otherwise unsuccessful experiments. Improvement in equipment and method was rapid. Air drying was standardized in 1935 with three simple rules (1) a fast method of heating must be available (2) free water left in the tubes because of poor drainage must be blown out with compressed air (3) air supply must be adequate.

Live steam was injected into the steam side of the condenser with a limiting temperature of 145 F set on the exhaust casing. Tubes in No. 5 and 6 have to be blown out, while No. 7 drains well. Four 1500-cfm fans were used. Total time out for the unit was reduced to 12 hr; Fig. 2 shows typical air-drying data for a drying-out period.

Air drying was superior to the rubber-plug method because it removed more deposit, was equally fast, caused less sickness and reduced the heavy labor involved. It still had the disadvantage of reducing machine availability; but the chief handicap was the same as all mechanical methods, it



3 Chlorination of condensers cleans tubes entirely after completion of each treatment. Regardless of cleaning method fouling increases progressively with use

TABLE II—ST. JOHNS RIVER WATER ANALYSIS VARIATION FOR THREE DIFFERENT YEARS

Water constituent	*November 1929*	*July 24, 1940 Sample 1*	*July 24, 1940 Sample 2*	*December 1946*
Total solids	1079.4	5590.0	7367.0	2672.7
Suspended solids	.....	.....	.....	10.3
Total hardness as $CaCO_3$	284.0	1028.0	1302.0	444.6
Calcium as $CaCO_3$	111.0	247.0	282.0	164.2
Magnesium as $CaCO_3$	173.0	781.0	1020.0	280.4
Phenolphthalein alkalinity as $CaCO_3$	0.0	64.0	12.0	0.0
Methyl orange alkalinity as $CaCO_3$	59.0	144.0	71.0	53.0
Free carbon dioxide as $CaCO_3$	7.0	.....	.....	0.0
Chlorides as NaCl	942.0	3866.0	5113.0	2154.6
Sulphates as Na_2SO_4	181.0	761.0	942.0	287.3
Silica as SiO_2	14.0	.....	.....	8.6
Alumina as Al_2O_3 } R_2O_3-3.4 {		0.0	0.0	Trace
Iron as Fe }		0.2	0.2	1.0
Phosphate as PO_4	.....	.....	.....	0.0
Hydrogen ion (pH)	6.8	7.1	7.3	7.3
Chlorine demand taken in 1933 = 3 ppm	.....	.....	.....	.....
Chlorine demand taken in 1947 = 11 ppm	.....	.....	.....	.....

TABLE III—ECONOMICS OF CONDENSER CHLORINATION TALLEYRAND GENERATING STATION

No. 7 condenser costs	*No chlorine used for year ending July 8, 1946*	*Intermittent chlorination, year ending July 8, 1947*
Excess steam cost due to fouling	$16,157.76	$2,517.74
Chlorine cost	0	2,197.64
Condenser loss due to fouling	$16,157.76	$4,715.38
Summary of savings:		
No. 7 condenser, steam saving		$11,442.38
No. 6 condenser, steam saving (estimated at 50% No. 7)		5,721.16
Cleaning labor		no credit
Sickness and accident		no credit
Better operating conditions		no credit
High machine availability		no credit
Total saving		$17,163.54

corrected the effect of slime formation but did not eliminate its cause.

Increased Fouling. During 1939 a paper mill was placed in operation adjacent to the station. The air-drying method was becoming less effective. Tube interiors of No. 7 condenser had a coating of grayish-green deposit, somewhat flaky in appearance. Analysis indicated tube corrosion with formation of water-insoluble carbonates of copper and zinc; 73.8% of the material was basic copper carbonate. Removing the coating, we discovered a large part of the tube surface was pitted, although the pits were not deep. Paper-mill waste water discharged to the river is highly alkaline, sample 2 in Table II.

A different cleaning method was tried, circulating a 1% hydrochloric acid solution through the water side of the condenser. Preliminary experiments showed no appreciable metal loss from copper alloy tubes or cast-iron water boxes in contact with this strength acid solution for periods of 1 hr. Results were excellent, as in Fig. 3.

This cleaning method requires blocking off the condenser discharge opening. It also proved expensive, needing 34 carboys of acid at $5 each, which made it undesirable for normal practice.

Since hydrochloric acid proved so effective in removing copper carbonate, chlorination was considered. Chlorine in water forms hypochlorus acid, which kills slime-producing organisms and also reacts with the inorganic material. Realizing that chlorine applications differ with plant characteristics, we put an experimental pilot plant in operation June 1941. Results exceeded expectations; a net saving of $2026 was made the first operating year compared to the previous year. These savings were based on a chlorine cost of 9¢ per lb. Fig. 1 shows the improvement for the trial period, June 1941 to June 1943.

Experimentation proving successful purchase of a commercial installation was approved, but war shortages delayed it till after the war. During 1944–5 all plant equipment was on the line most of the time. The pilot-plant chlorinator, capable of handling only 4 lb per min of chlorine. failed to keep up with the job of supplying chlorine demands of 10 to 15 ppm, especially in the face of increased circulating-water utilization.

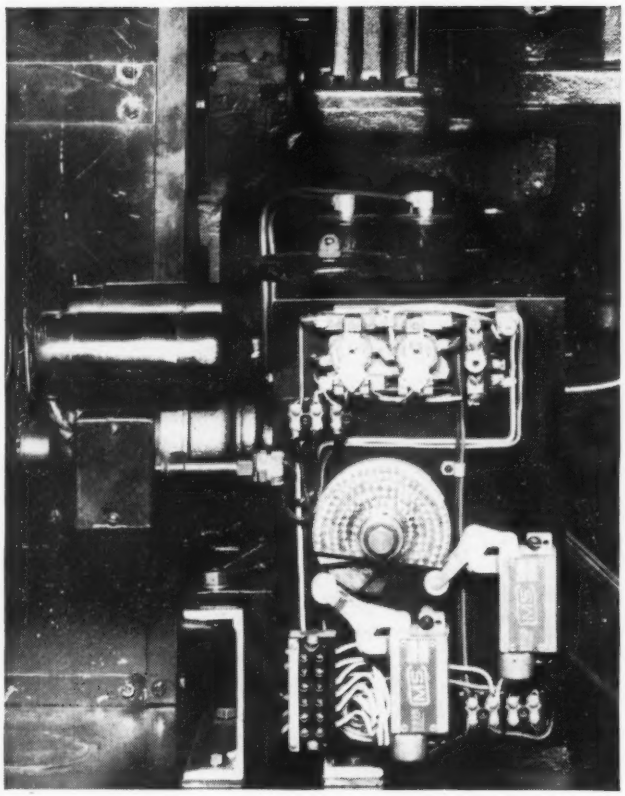
War took its toll of skilled operators, imposing greater burdens on those left. The pilot plant was a war casualty. Cleanliness factor fell to an average of 38% the first six months of 1946, Fig. 1. Steadily increasing oil costs helped raise the condenser excess operating cost to $1450 a month.

Installation of two Wallace and Tiernan 6000-lb-per-day chlorinators was completed June 1946, and believed to be the largest setup of its kind in Florida. Housed in a separate building outside the plant, a 6-in. rubber-lined header carries the chlorine solution into the plant. Four- and 5-in. branch headers, with water-operated shutoff valves controlled electrically from the chlorine house, carry the solution to the point of application. Condensers No. 5, 6 and 7 can be treated simultaneously or separately. Every effort was made to install a flexible system of sufficient capacity to insure adequate chlorination, whatever future demands might be. Two treatments are being made each day to each unit in service.

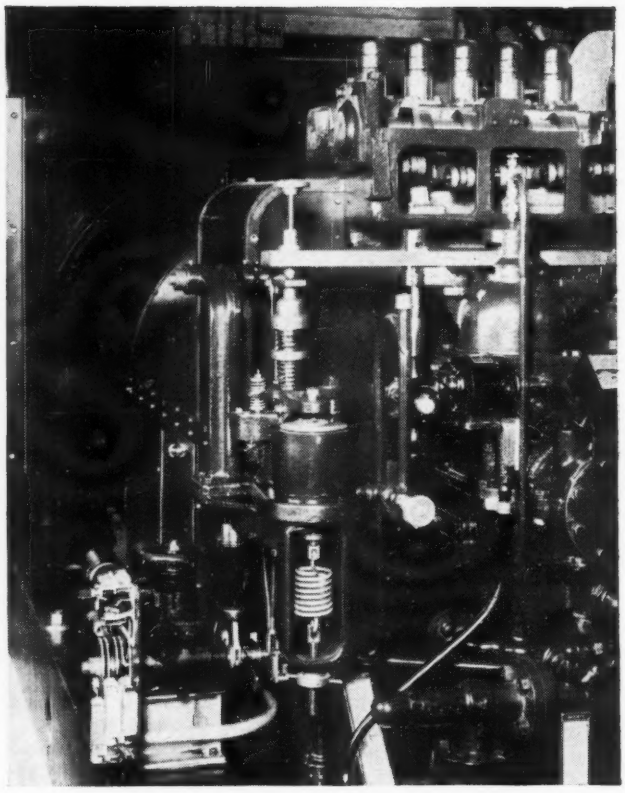
Recently, failure of several sections of rubber-lined header because of poor fabrication led us to air-dry No. 5 unit. A return to this method hospitalized two of eight workmen, and two others suffered disturbing illness. Stream pollution is continually increasing.

It is not often that equipment purchased satisfies every consideration the way the chlorinating equipment does at Talleyrand. As an investment the installation will pay for itself in two years. Table III shows the saving. From an operation standpoint, chlorine supply is ample when and where needed. Because of the local corrosive water supply, maintenance was the least satisfactory factor, requiring 300 man-hours the first year.

(*Continued on page* 138)



1 Automatic governor control, responsive to both purchased or primary power and plant demands, is shown without cover



2 Control varies unit output within range from no-load to full-load setting of regular governor but not beyond it

Purchased Power Held

To prevent purchased power becoming the tail that wags the dog, here is a working control. It keeps power demand within limits, avoids generating excess energy, maintains process pressure

By **FRANK O WALLENE**
Consulting Engineer, Cleveland, Ohio

▶ AN INDUSTRIAL PLANT that requires steam for process the year round often finds it advantageous to buy some power and generate the remainder. Savings can be substantial when such a plant uses a turbine or engine in place of a reducing valve to bring boiler pressure down to required process levels, and—in the expansion to lower pressures—to generate electrical energy for power-plant needs. It takes only a fairly simple engineering study to determine whether a turbine-generator installation is feasible.

Principal shortcoming of such an arrangement has been that plant demands for process and power seldom if ever vary concurrently. As a result costly peak demands on purchased power occur that seriously affect the over-all savings.

Successful Experience. Ohio Leather Co, of Girard, Ohio, met this situation by installing a turbine that is provided with an automatic governor control, Fig. 1 and 2, responsive to both purchased or primary power and plant demands for process steam. And the saving effected indicates a complete return of investment in less than three years after deducting interest, depreciation and taxes, despite operating only ten hours per day, five days a week.

The unit, a 750-kw straight noncondensing type, designed for 250 and 5 psig exhaust, operates in parallel with the purchased source of power. The automatic governor control varies the output of the unit within the range from no-load to full-load setting of the regular governor, but not in excess of this setting. Thus all safety features of the standard governor are in control.

Fig. 5 and table on p 84 show how automatic governor control provide for the following conditions:

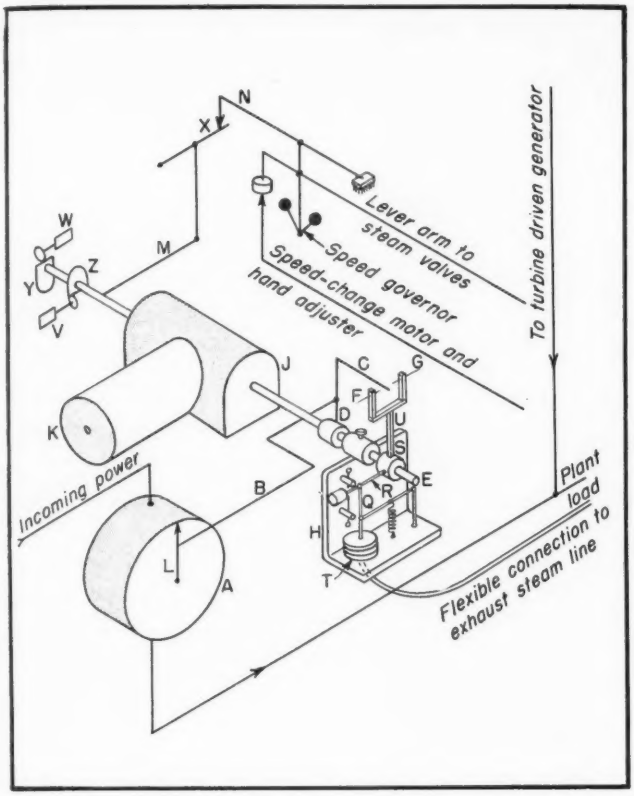
(1) Limits maximum demands on the primary purchased source to a predetermined top level regardless of plant-process steam demands.

(2) Limits minimum demands at a fixed level so as to prevent return flow of power to primary source when plant steam demands may be high and electric-power demands low.

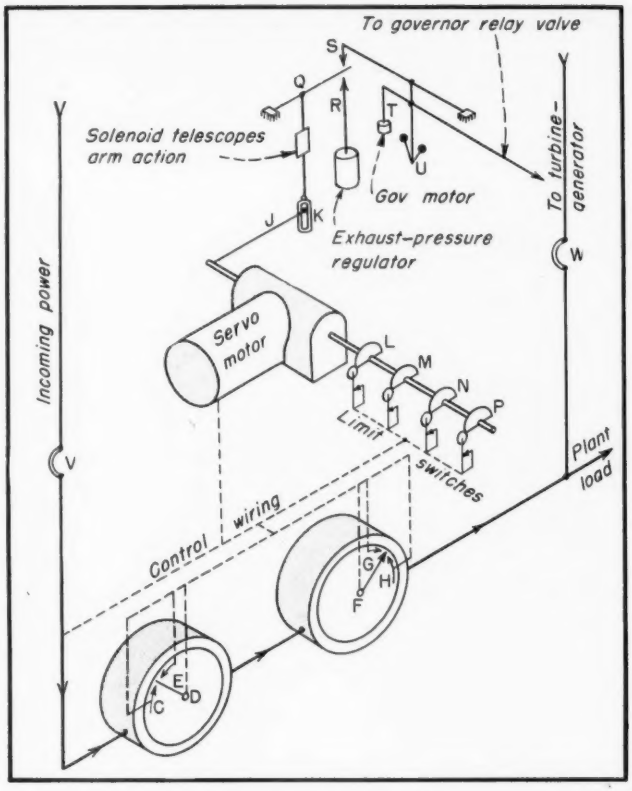
(3) With the minimum demand set at a fixed point, the maximum demands are automatically varied in the range from the top fixed position to the minimum one, depending on steam demands.

The control is provided with means to alter easily and accurately the maximum top fixed-limit while the unit is in operation. Thus advantage can be taken of power rates that permit higher peaks without penalty during certain periods.

Control Design. The standard design of control uses one wattmeter element relay with the pressure element a coun-



3 Standard governor control uses one wattmeter element as a relay with the pressure element a part of the control



4 Turbines already equipped with backpressure regulators tie into the control unit through two wattmeter relays

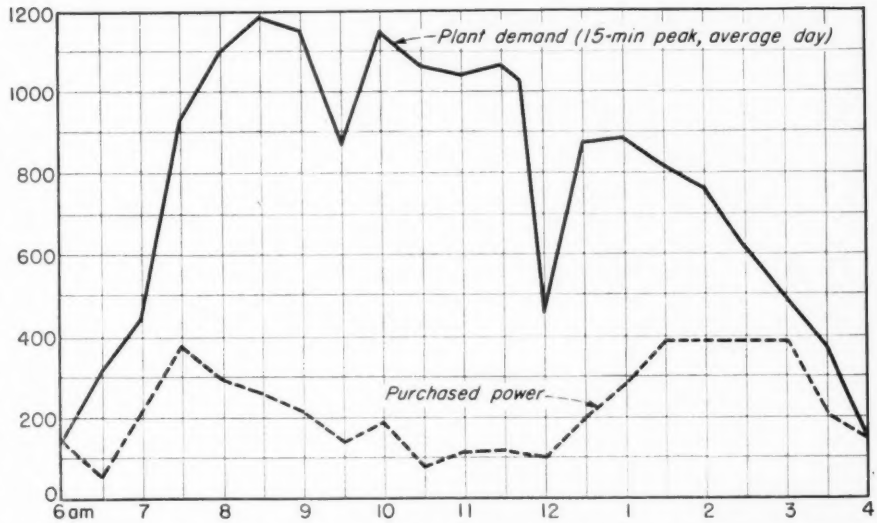
Under Control Aids Process Plant

terpart of the unit, Fig. 3. In the Ohio Leather Co's installation the turbine was equipped with a backpressure regulator built into the governor. The control, therefore, has two wattmeter element relays, one set for maximum, the other for minimum, as in Fig. 4.

The relays have contact points *C*, *E*, and *G*, *H*, between which float indicator arms *D* and *F*. These relays are identical except contacts *C*, *E* are on the lower range of the scale, while *G*, *H* are on the upper range.

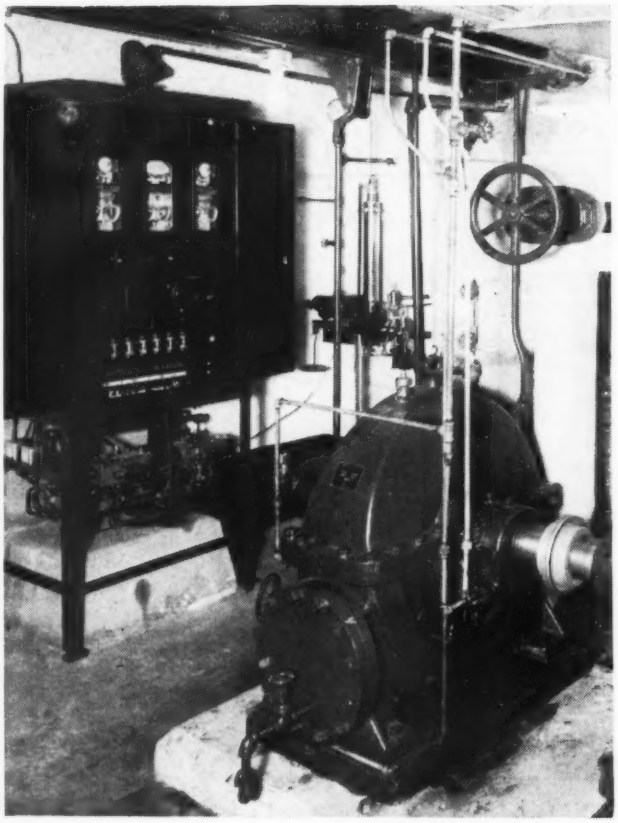
Deflection from *C* to *E* and *G* to *H* is about 5% of full scale, and is adjustable. Settings here are (1) 400-kw maximum purchased-power peak demand (2) 50-kw minimum demand on purchased power. To meet these conditions contacts *C* and *D* close when incoming power is 50 kw or less—*D* and *E* when 100 kw or more—*F* and *G* when 350 kw or less—*F* and *H* when 400 kw or more.

When incoming power load is between 100 and 350 kw arm *J* stops at halfway point with clevis *K* in position to permit exhaust-pressure regulator to function through its full range of control.



5 Comparison between purchased-power peak demands, before and after governor control went to work leveling off purchased power peaks, shows in these charts

Arm *R* is spring loaded so the servomotor can take over control at any time regardless of position of the exhaust-pressure regulator. This permits the all-important "peak demand" to supersede other factors. If excess exhaust pressure develops beyond the desired



6 Unit size has little bearing on application of control. Changing transformer ratios fits it for small-unit service

HOW CONTROLLER REGULATES OUTPUT

With turbine unit in parallel with purchased power, controller regulates turbine output to meet the following conditions:

1. **Peak demands on purchased power must not exceed a preset value of 400 kw**
2. **Minimum demands on purchased power must not fall below preset value of 50 kw**
3. **Process steam demand shall determine power output of turbine unit between limits set by 1 and 2**
4. **All safety features of the standard governor shall always be in full control. (Range of operation of the controller, therefore, must lie within no-load to maximum as determined by the usual governor motor setting.)**
5. **Control shall instantly trip out in event of purchased-power failure to restore full control to the governor. At the same time the voltage regulator shall be made operative.**
6. **Any condition that causes the throttle to trip closed must also trip the generator breaker.**
7. **Limits of the control shall be readily adjustable while the unit is in operation so that any operational or seasonal changes can be met with relative ease and accuracy.**

limit, steam is vented to atmosphere.

At the other operating extreme where power demands are so low that available exhaust steam proves insufficient to meet plant demands the usual make-up reducing valve bypasses the turbine.

Safety features of the governor, which cause the throttle to trip, also trip breaker *W*, and cause control to assume minimum power position.

Incoming breaker *V* is provided with overload and reverse power trip. When tripped, the control assumes full power position and voltage regulator also goes into operation. Thus an incoming power failure positions the turbine to assume its full power-generating capacity.

Cams *L*, *M*, *N*, *P* Fig. 4, are set on the servomotor shaft to engage limit switches which control movement of arm *J*. If relay contacts open because of restored load conditions, arm *J* comes to rest before limit switch opens.

Standard Unit. Fig 3 shows the standard unit, which includes the pressure element. In limited steam-generating capacity or scarcity of product fuel when boiler pressure becomes the criterion, the pressure element is used with reverse action. Long-distance telemetering may be used to eliminate bringing incoming power to the power house for any load-response purposes.

Referring to Fig. 3 showing the standard type of control unit, *A* is the wattmeter-element with pointer *L* free to swing full-scale. By using resistances in the potential circuit and proper current transformer ratios the full-scale swing establishes the permissible maximum demand with provision for adjustment. Movement of pointer *L* is transmitted to arm *C* carrying the center or floating contact between so-called stationary contacts *F* and *G*. Collar *D* supporting arm *C* is loose on shaft *E*. If there is no pressure change in bellows *T*, collar *S* supporting contacts *F* and *G* is in effect held rigid on shaft *E*.

Contacts *C*, *F* and *G* start and stop servomotor *K*, which rotates shaft *E* through gear box *J*. *V* and *W* are travel-limit switches. Arm *M* raises and lowers arm *N*, which changes the load setting of the governor. Since arm *X* can raise but not pull down arm *N*, the load cannot be increased beyond the synchronizing motor setting. As a result, all safety features of the regular governor are in constant control.

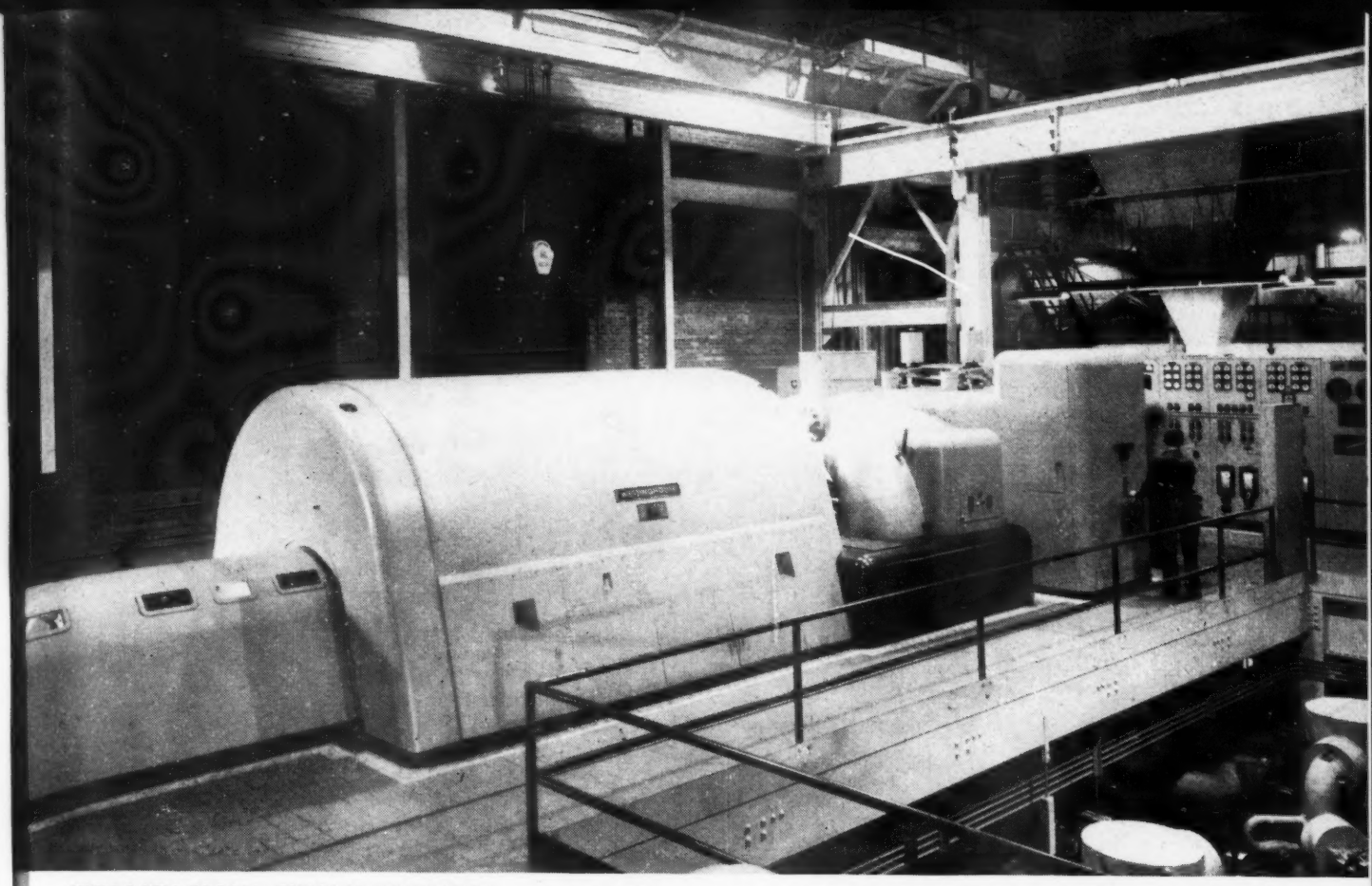
As the pressure diminishes in bellows *T* and collar *S* rotates on shaft *E*, permissible demand from incoming power is reduced, and vice versa, since bracket *H* is fastened to the shaft.

In practice, arm *B* is actually a pair of Selsyn motors. Element *A* is on the switchboard while the servomotor unit is mounted on a pedestal near the turbine governor. Where a number of turbines are to be controlled there is one Selsyn motor for each turbine, mounted on the switchboard with one servomotor unit for each turbine.

By merely changing transformer ratios, any size power unit can be handled. For instance, Fig. 6 shows a 1000-gpm pump, driven by a 75-hp motor coupled to a 150-hp turbine.

Steam exhausting from the turbine went to low-pressure process. As low-pressure steam demands increased more steam passed through the turbine until it was not only assisting the motor but actually driving it as a generator.

If pump load drops off and low-pressure steam demands stay high, without a control, steam passing through the turbine could develop as high as 150 hp with only the 75-hp motor to absorb the energy. A set of relays, part of the control system, act to reduce steam admitted to the turbine. Thus total output is held within the limits of the motor-generator to absorb this steam.



HYDROGEN-COOLED TURBINE-GENERATOR rated at 15,000 kw. After unit is installed it is plant operator's responsibility to inspect lube system, and see that preliminary flushing and displacement oil prepares turbine suitably for the final oil charge

Guide for Plant Operator in Preparing New Turbine Oil System

ASTM committee* recommends following procedure in preparing lube system of direct-connected turbine for first oil charge. Cooperate with oil supplier and builder to insure best results

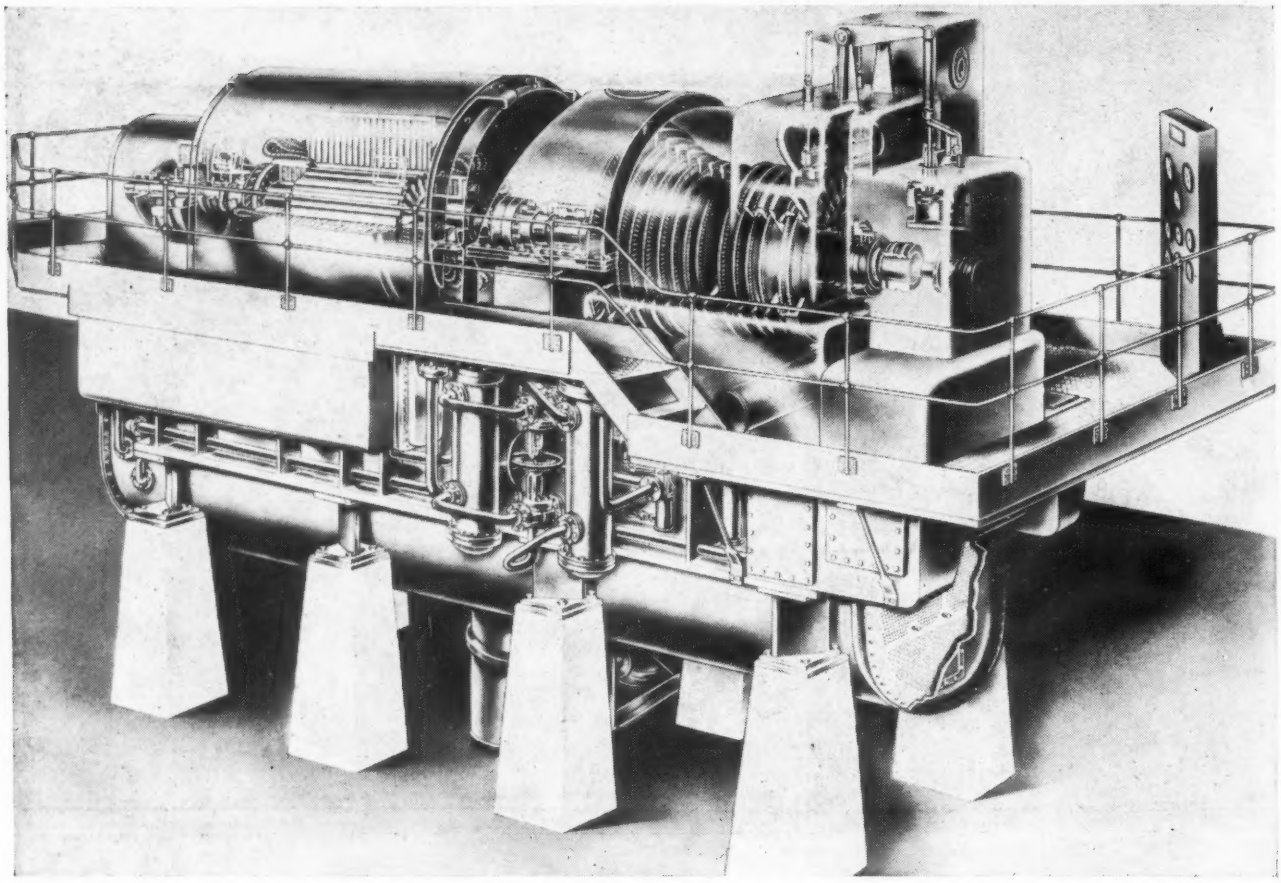
▶TURBINE OIL, in a direct-connected unit, is called on to perform several tasks during normal service. Primarily, its job is to lubricate the turbine bearings. In addition, it dissipates heat and acts as a lubricant for the governor mechanism. Often it is used to lubricate auxiliary equipment. and thus avoid maintaining another oil system.

To do these jobs well turbine oil must get a fair start in life; hence the preparatory steps before putting the first charge of oil into a new turbine are mighty important. Why? Well, to better understand this problem let's take a look at what many manufacturers consider good practice in treating a lube system after fabrication. The manufacturer cleans piping thoroughly. To remove any paint and oil, he immerses it in a hot alkaline cleaning solution. After this it is washed and pickled by dipping in hot hydrochloric or sulphuric acid. Piping is then rinsed and dried, and a petroleum-base rust preventive applied.

In preparing bearing pedestals, bearing brackets, valve gear parts, etc, the manufacturer often cleans the surfaces to be exposed to oil by wire brushing or chipping, and then applies a rust-preventive coating. Likewise, oil tanks are cleaned of all grease and scale, and covered with an oil- and water-resistant paint or a rust preventive.

Operator's Responsibility. After the new turbine is in place, the plant operator's big job is to see that all rust-

* Based on report prepared by representatives of turbine builders, operators, oil suppliers, turbine-equipment suppliers and consulting turbine engineers, forming American Society for Testing Materials Committee D-2, Technical Committee C—Section I. Written as a guide to desirable practice, original paper, "Recommended Practices for the Preparation Of New Turbine Lubricating Systems," covered in addition a detailed procedure for preparing lube systems of geared and marine turbines.



PHANTOM VIEW of 5000-kw turbine-generator package unit. Control simplified by locating steam condenser, lubricating-system components and machine controls in one unit. Rust preventives must be completely removed before adding first oil charge

preventive coatings applied by the manufacturer, and any dirt that may have found its way into the system, are completely removed before the regular lubricating oil is added. If not, these contaminants will reduce the normal life of the oil and may affect turbine operation. A new turbine lube system is properly prepared when turbine builder, operator and oil supplier pool their efforts.

General Inspection. After the turbine is in place and before any part of the cleaning job is started, the entire lubrication system should be thoroughly inspected. Carefully check for any peculiarities, such as air pockets or areas of poor drainage, which may cause trouble when the turbine is put in service.

This initial inspection will also tell the extent of the cleaning job required before oil or flushing fluid is introduced into the system. In addition to removing the thick rust-preventive film, wire brushing, blasting and sweeping are often necessary for removal of welding shot, chips, sand, etc. Throughout the cleaning process and in later steps of the work, use lintless wiping cloths. Lint accumulation from cleaning cloths has been known to cause plugged oilways after the unit is in operation.

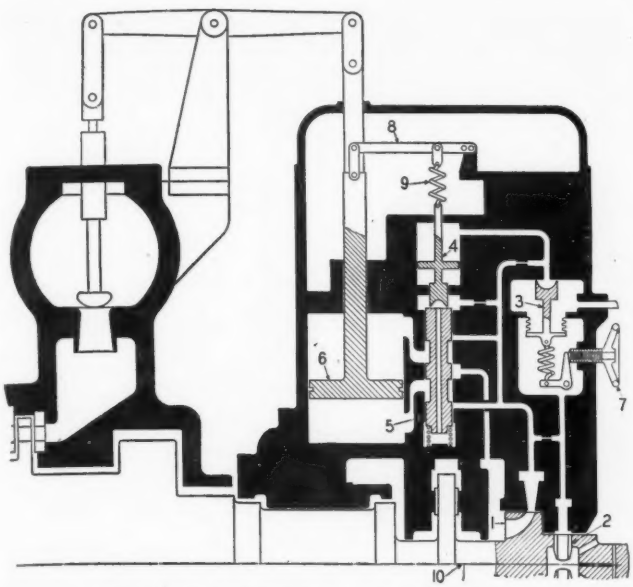
Flushing the System. After the preliminary cleaning the next step is to send a charge of flushing oil through the lube system. Make provisions to prevent any of the flushing oil from entering bearings. This can be done best by installing closed flanges at bearing-oil inlets and connecting a bypass across each bearing. On small installations, or wherever this procedure cannot be justified, the bearing shells should be removed or rotated to prevent flow of oil through them. In rotating the bearing be careful that the flow of high-pressure flushing oil is not blocked.

It may be best to sectionalize piping and flush each section separately, depending on size and layout of the system and capacity of the pump used to circulate the flushing oil.

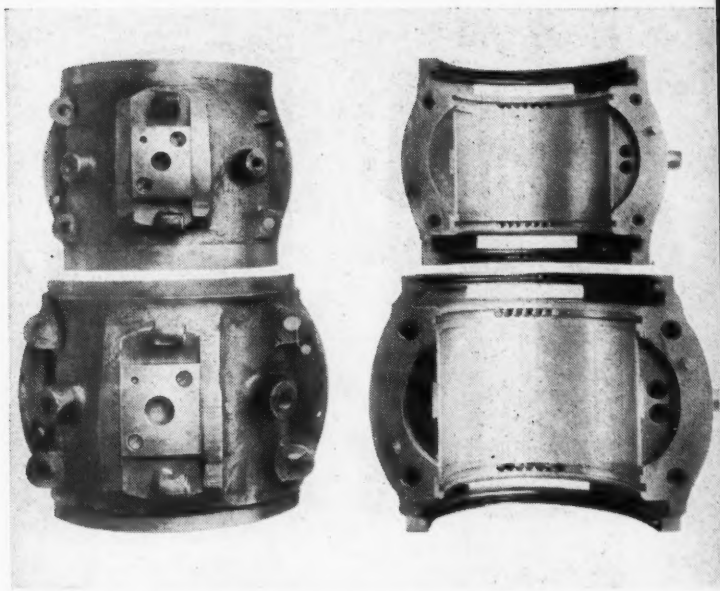
One of the reasons for flushing a system is to remove any rust preventive materials that may be present. If the manufacturer's rust preventive is not readily soluble in turbine oil, it should be removed before assembly. Choice of a solvent depends on the type of rust preventive. When it is oil soluble and can be flushed away, use a flushing oil with the same or lower viscosity than the recommended lubricating oil. For the latter method, it is best to select a flushing oil with the same type of rust inhibitor as the final oil charge. Use sufficient flushing oil so there will be continuous circulation with the auxiliary oil pump.

Heating the Oil. The circulating flushing oil should be heated to 125-180 F. Heating the oil above the maximum temperature to be expected when the unit is put in service is desirable because it expands the piping to a greater degree than is met with in service. This effectively loosens scale and other adhering material. For heating the flushing oil any of the following means may be used, with due precaution to prevent localized overheating of oil: (1) Pipe steam at a pressure of 3-5 psi to the water side of the main lubricating-oil cooler. (2) Install temporary heating coil in the lubricating-oil sump tank. (3) Install temporary heater in the piping system.

It is important that a filter or centri-



STEAM GOVERNOR SHOWING: 1, 2: oil pumps; 3: pressure transformer; 4: relay piston pilot; 5, 6: servomotor relay & piston; 7: speed changer; 8, 9: lever and spring; 10: shaft



INSTALL CLOSED FLANGES at bearing oil inlets to prevent the entrance of flushing oil. With bearings thus blocked, connect a temporary jumper or bypass to allow lube-oil circulation

fuge be used continuously during the flushing operation. Where the system is not equipped with a purifier, install an auxiliary filter to remove suspended contaminants which would otherwise be carried through the system.

Circulation of hot flushing oil should be continued for a period varying from four hours for smaller units to 96 hours or longer for larger turbines. Following this flushing operation drain all oil from the system, taking particular care to drain all low points in the piping, coolers and governor mechanism. Remove any heavy solids that have been flushed into the oil reservoir. Inspect and clean the bearing pedestals and the governor hydraulic mechanism.

On small systems and those where no rust-preventive materials have been used the initial flushing charge may be the same type oil that will be used later as the lubricant. The procedure is similar to that already described.

Displacement Oil Charge. To completely remove all flushing oil and any contaminants it may have carried into solution, it may be desirable to follow flushing with a charge of displacement oil. This decision should be left to the good judgment of the oil supplier and turbine engineer. Factors to consider include type and viscosity of flushing oil and general cleanliness of the system. Displacement oil should be the same type as the recommended lubricant. This oil is heated to 130-150 F and circulated for about two hours.

Since viscosity of the oil is often higher than the flushing oil, some contaminants that were not removed by the less viscous oil will be suspended and flushed out. Inspection of the centrifuge or filter at this time tells if the system is clean. If so, the blind flanges and jumpers that were initially installed may be removed and circulation continued through the bearings for an hour or two. During this circulating period, the governor mechanism should be operated to flush it completely.

After this recirculation period. if practicable remove and inspect all accessible bearings; if they are in satisfactory condition, the system may be considered clean. During drainage, attention should once again be given to all low points in the system. Wipe out the oil reservoir with lintless cloths and remove any loose solids. Care at this point may save you time and trouble after the turbine is in service.

Experience has shown it is entirely satisfactory to operate a turbine for a period up to a few weeks on the displacement charge on systems where particular care has been taken during fabrication and erection. This procedure may be followed when laboratory tests indicate the displacement charge is in satisfactory condition with particular regard to viscosity and cleanliness.

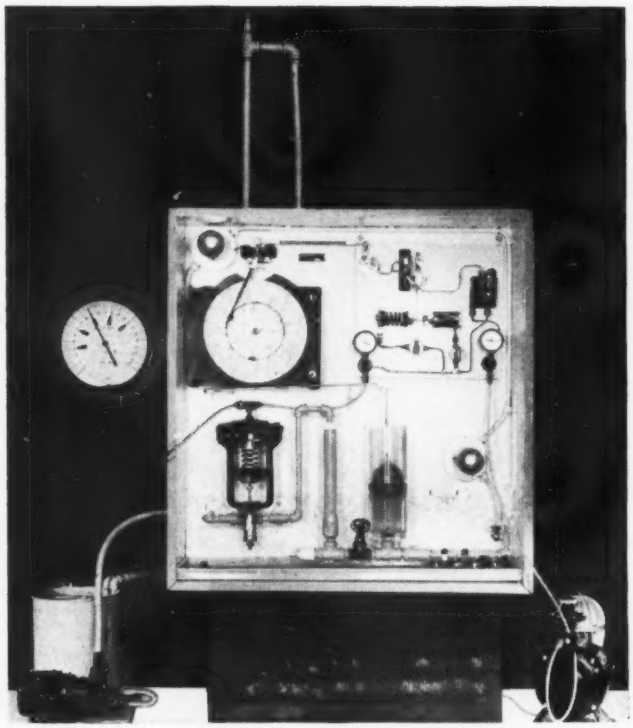
Where operating requirements permit this schedule, the difficulties frequently encountered in operation of a new system can be worked out before the final lubricating oil is introduced.

CORRECTION NOTICE

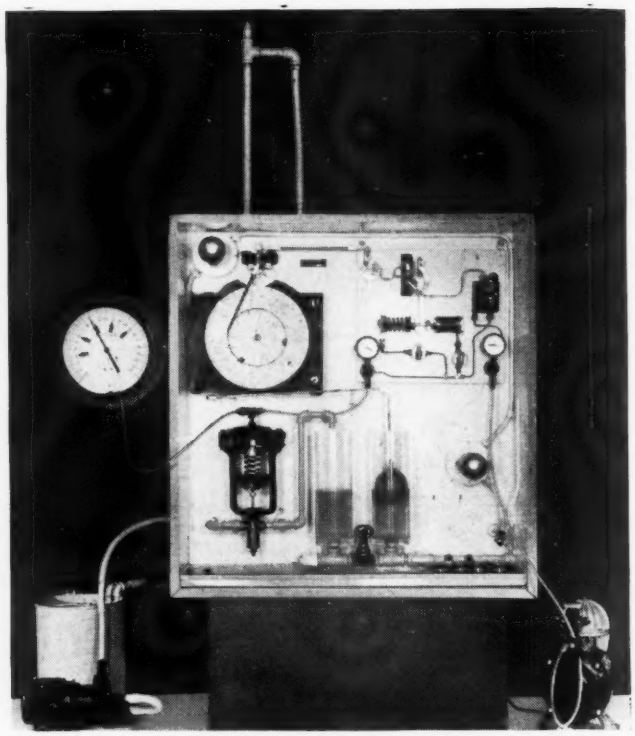
In the article, "Internal Conditions of Old Boilers Guide Water Treatment For New Units," POWER, September 1948, pp 88-91, the following changes should be made:

On p 89, col 2, par 2, the last two sentences should read: "Aluminum silicate was also found in the analcite scale formed in Sept 1944. This indicated that the feedwater must have contained considerable suspended matter, as aluminum silicate in relatively small amounts would not normally remain as such very long in high-temperature, alkaline boiler water."

On p 90, col 2, second sentence of first complete paragraph as originally printed read: "But should silica removal prove necessary, this system of softening would provide therefor." This statement is in error and should be: "But should silica removal prove necessary, this system of softening would *not* provide therefor."



1 Using a bellows to position nozzle gives controller linear and proportional action for every position of baffle



2 Employing 2-tank system and restricting valve illustrates effect of introducing time lag between inflow and float

Working Model Simplifies the

With a demonstration panel it's easy to instruct plant men in operating and caring for control instruments. Conclusion of a 2-part lecture by G F Akins, instrument engineer, Eastman Kodak Co

►Recalling the statement in Part One (Power, Sept 1948, p 82)—that one major requirement in a controller is to allow a baffle travel of 0.25 in.—let's find out how we can permit such movement and still hold nozzle-baffle clearance within 0.002 in.

If the nozzle can be made to move through a given distance, and its travel be proportional to the instrument's output pressure, the baffle can be moved a total distance of 0.25 by using a suitable mechanical arrangement. Yet the nozzle will always maintain a slight clearance with the baffle.

Minute clearance changes noted in the low-pressure nozzle become useful in the new scheme, since by utilizing an air relay, the slightest change in baffle clearance causes an immediate change in output from the relay. The problem now becomes one of converting output pressure change into proportional motion of the nozzle to cause it to seek out the baffle's position.

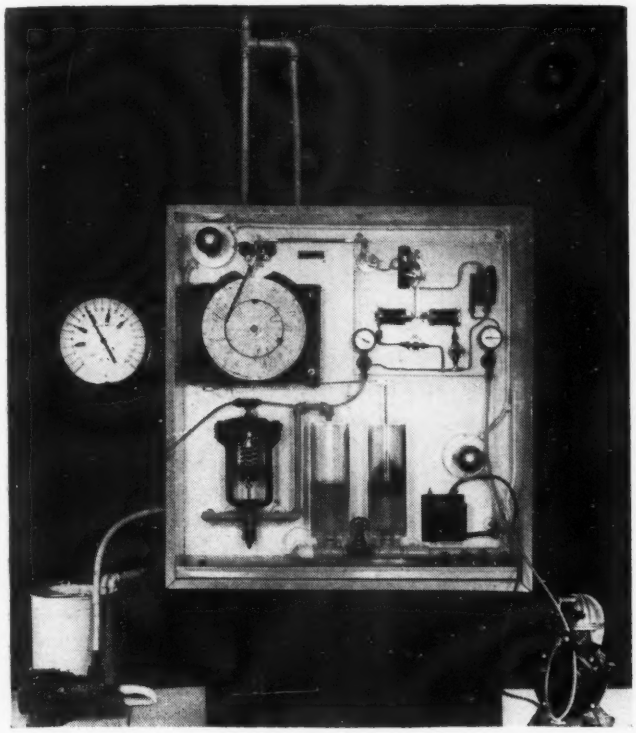
Bellows Pressure. A ready means of transforming pressure changes into motion is a spring-opposed bellows. By increasing or decreasing pressure within the bellows, motion of its free end is proportional to the pressure change. Incorporating the bellows motion to position the nozzle. Fig. 1, we have a controller that produces linear and proportional action for every position of the baffle.

In Fig. 4, pen motion through a connecting link (upper left) and a pivoted lever raises or lowers the baffle 0.25 in. as the pen travels full chart width. Below the baffle, a nozzle rotates about a pivot to hold continuous alignment with the baffle.

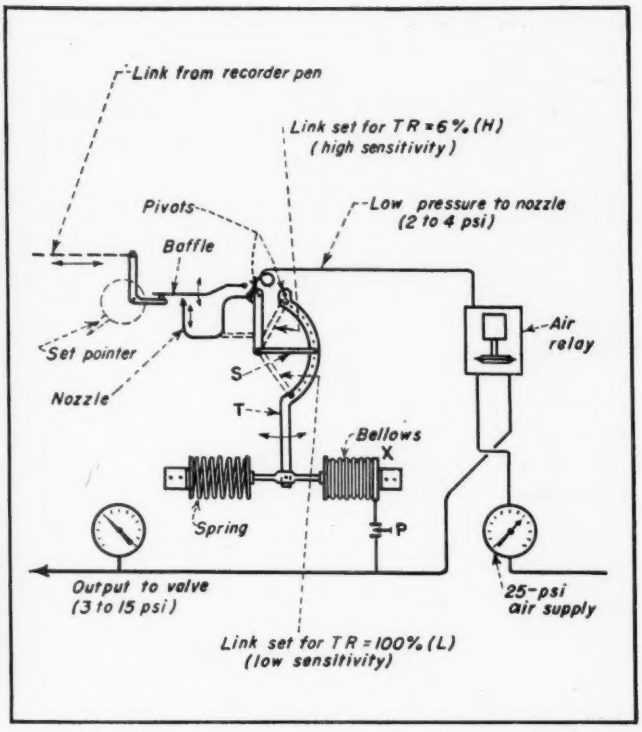
Backpressure created by the nozzle is carried to the air relay (at right) which gives an instant change of output pressure at the slightest change in low-pressure impulse from the nozzle. Air output line from the relay divides into two branches—one line going to the main control valve and the other to bellows *X*. A spring opposite the bellows provides a movement proportional to the change in output pressure. Bellows and spring are designed for a total travel of ½ in. when output from the instrument changes from 3 to 15 psi.

Lever *T*, pivoted at its upper end is so arranged that any change in bellows position is transmitted to the nozzle by adjustable link *S*. With link in its extreme lower position (point L), bellows motion of ½ in. causes the nozzle to move 0.25 in. For every value of output pressure, there is a definite and corresponding nozzle position.

Nozzle Follows Baffle. As we place the baffle in midposition of its 0.25-in. travel and turn on the air, the extreme clearance between nozzle and baffle causes the output pressure to climb rapidly to 9 psi, and thus force bellows *X* to expand to its midposition. This motion, through link *S*, causes the nozzle to move to its midposition and establish a clearance of 0.004 in. with



3 Opposing pressure-loaded bellows replaces loading spring of Fig. 1 and 2 to give a reset action to a controller



4 Bellows loaded by output air pressure moves the nozzle proportionately to keep it a proper distance from baffle

Theory of Automatic Control

the baffle. Slightest deviation from the 0.004-in. clearance causes an immediate change in output, thereby producing corrective action through the bellows and linkages to reset the nozzle. For any other baffle position, a corresponding output pressure positions the nozzle at prescribed distance from the baffle.

Placing link *S* in its lowest position to produce a throttling range of 100%, let's investigate proportional response of the new device.

Setting the pen at *O* on the chart, output from the controller becomes 3 psi and the control valve is fully closed. Moving the pen to 50 gives 9-psi output, and finally as the pen is moved to 100, output increases to 15 psi and control valve is wide open. For any other pen position, Fig 7, output pressure has a corresponding and proportional value, Table I, p 92.

Setting the loading petcocks at 50% load, the controller creates 9-psi output pressure, Fig. 1, to open the control valve to its 50% flow rate. The process becomes stable and remains so as long as load does not change. If we increase the load to 75%, tank level drops and pen moves to 75; baffle assumes a new position and output pressure registers 12 psi, causing valve to reach its 75%-flow position.

Process is again in balance, *but not at desired control point of 50 on chart.* This demonstrates that any proportional-type controller, whether the design is simple or complicated, follows the same pattern; that is, to correct for a process-load change, measured level must rise or fall to send corrective impulse to the control valve.

Results Gained. At first glance this controller appears little better than a simple float valve but remember we wanted to operate large valves from small impulses generated by a bourdon spring or similar device. Our controller not only fulfills these requirements but allows far greater adjustability than does the mechanical leverage of the float valve. A new control point can be readily established by merely moving the set pointer, Fig. 4, to change baffle-link pivot position. The throttling (proportioning) range of the instrument can easily be altered by moving link *S* to a new position on arm *T*.

Suppose we move *S* to its midposition. Pen now traverses only 50% of chart to produce full output change of 3 to 15 psi. To reduce amount of offset with load change we may wish to reduce the throttling range to the minimum, as, for instance, placing link *S* in its uppermost position to produce 6% throttling.

If the process has favorable control characteristics, this setting may overcome the difficulties of offset because a very slight motion of the pen is enough to reposition the valve to a new flow rate. If the process is of a more difficult nature such narrow throttling is undesirable. As an example, let's investigate the influence upon controller settings as established by the process.

Putting in operation a controller with 6% throttling range, we find it very unstable. Chart curve is similar to that of an on-off instrument. As an experiment, let's transfer this controller to a process having a greater tank capacity, Fig. 2. We can do this by installing a second tank in the line. Following a number of overshots, the control finally becomes stable. This shows process characteristics, such as capacity, affect proper adjustment of a controller.

The double-tank system represents

a relatively easy process to control since no time lags are present. A more difficult process requires careful adjustment of the instrument to attain stability.

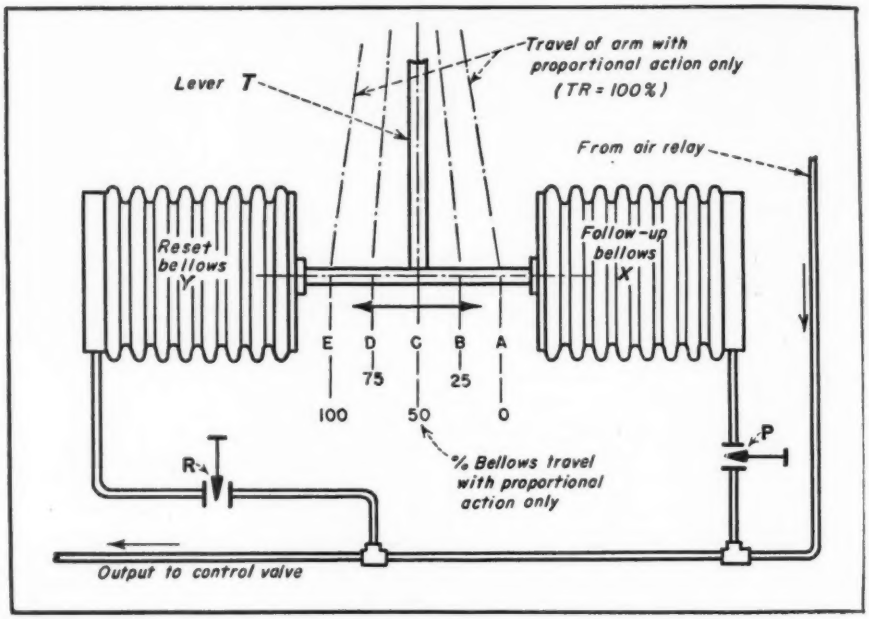
Thermal Lag. Assume the left-hand tank represents heat inflow or steam input to an air-heating coil. Water flow from the tank now represents heat flowing through the coil wall. By imposing a restriction to water flow from the first tank we can simulate resistance to heat flow through the pipe wall, (thermal lag). To provide this restriction, a small hole is drilled in gate of valve between the two tanks. With valve closed, water flow is restricted to the small opening. Right-hand tank represents temperature level of surrounding air, and it is this level we wish to control.

Closing the gate valve introduces time lag in system, and left-hand tank level begins to rise because of restricted outflow. We now visualize continued inflow of steam to the coil (first tank), but because of thermal resistance (small hole in valve), heat is delivered slowly to surrounding air (second tank). With continued addition of steam, temperature level of air (water in second tank) rises enough to cause the controller to close the supply valve. Level in left-hand tank is still abnormally high and because of the time lag, it recedes slowly. Excess water in this tank corresponds to heat stored in the walls of a heating coil when supplied with too much steam.

As air temperature gradually drops (level in second tank), the controller again comes into action to open the valve. Cycle then repeats because the valve tends to overshoot desired flow rate necessary for stable operation. The cyclic condition may continue indefinitely and at best requires considerable time to dampen out. We can conclude that the throttling range of the instrument must be increased to stabilize the system.

Effects on Offset. Increasing the throttling range also increases amount of offset from the control point experienced with a load change, so we need automatic load-change compensation. Before designing such automatic compensation, let's investigate operation of a proportional controller having 100% throttling range when the load changes.

Making necessary adjustments, we set the petcocks for 50% load. Output pressure settles out at 9 psi and the process reaches stable condition. With 9-psi output pressure, lever *T*, Fig. 4, is in its midposition since movement of bellows and spring mechanism is proportional over a range of 3- to 15-psi



5 Two opposed bellows connecting to nozzle arm gives both proportioning and reset action if restricting valve to bellows Y is adjusted to match the process needs

output pressure. Remember when the pen is at midpoint, the baffle is at its midpoint, and output is at midpoint of its range. Consequently, lever *T* is at its midpoint of travel, and thus the nozzle is correctly positioned in relation to baffle. With a change in pen position, all the foregoing parts move in proportion to magnitude of change.

If we change the process load to 75%, the float drops, pen moves up scale, and as the controller mechanism gradually reaches a new point of balance, output pressure reaches 12 psi. Control valve now passes a flow equivalent to 75% load and the process is again in balance. Examination shows that lever *T* has moved to the left and now occupies a position corresponding to 75% of its total travel.

Seeking some way to return the process to its original control point and still maintain balance at 75% load, we first analyze the condition of the process. It is evident that tank level is below the desired control point, so the valve must be opened farther to admit more water. To do this we must increase the output air pressure.

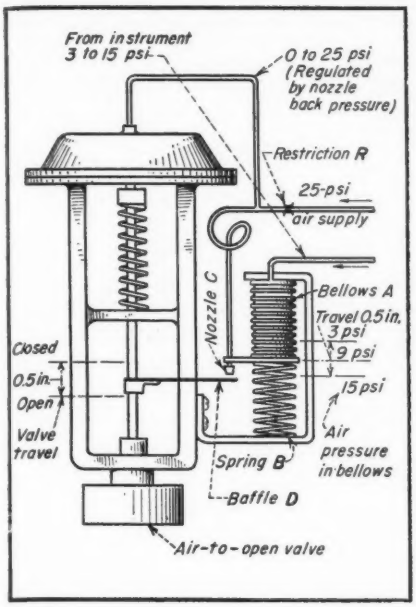
By disturbing the nozzle-baffle clearance the amplifying action of the relay produces the desired increase. Compressing bellows *X* to cause such a disturbance returns lever *T* to its original midposition. Output air pressure immediately increases, controlled valve opens, and tank level rises to its original position. Pen has now returned to the desired control point.

If repositioning of lever *T* needed the application of an external force to the bellows and spring unit in a direction to further oppose bellows action, and the load change experienced caused an increase in output from 9 to 12 psi, an auxiliary bellows, so placed to oppose bellows *X*, would supply the needed external force if the 3-psi change were utilized as the restoring power. Let's investigate replacing the spring with a bellows.

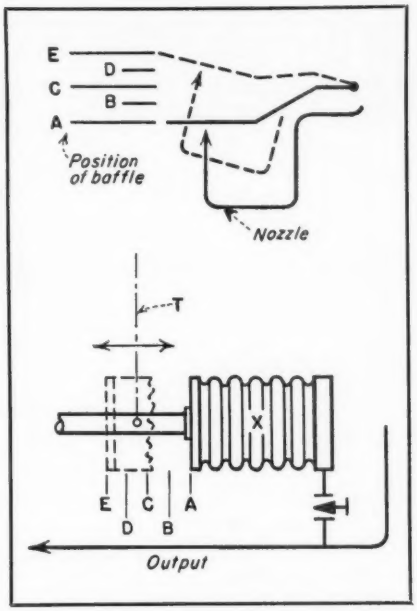
Referring to Fig. 5, bellows *Y* replaces the spring and opposes bellows *X*. If *Y* is to furnish an opposing force equal to the spring a given amount of air must be trapped within it. At a starting point, let's charge the bellows with normal output pressure of 9 psi required by the controller to maintain stable control at 50% load and close valve *R*.

After adjusting link *S* to compensate for a slight variation between spring and inflated bellows, the controller reproduces the 100% proportioning action obtained with the spring-opposed bellows. This action can be checked by moving pen, Fig. 3, across chart and observing the proportional change of output pressure.

Eliminating Offset. Allowing the process to reach stable control at 50% load, we now increase the load to 75%. As with the previous controller, as the pen moves to 75, output pressure gradually reaches 12 psi and lever *T* moves to the 75% position. We now want to return lever *T* to its midposition and thereby upset the nozzle-baffle relation-



6 Nozzle-baffle system mounted on valve positions the stem accurately



7 Nozzle position, determined by lever **T**, controls output pressure, Table I

ship to rebalance the system. By opening valve *R*, Fig. 5, we can admit output air at 12 psi into bellows *Y* and force lever *T* to its midposition. At this point both bellows *Y* and *X* are charged with 12-psi pressure and reach a position of equilibrium just as they were when equally charged with 9-psi pressure. In both cases, lever *T* is at its midposition. Table II shows this stepwise reset action.

The process has rebalanced during this procedure and the pen has returned to the control point within the color band. As we observe the process action, controller appears to behave like an on-off unit. Process has fallen into a cyclic state and pen continues to surge first above and then below the desired control point (color band).

Reason for the on-off behavior is obvious as we watch opposing bellows *Y* work, Fig. 5. With valve *R* fully open, both bellows receive an equal impulse from the output line. So no motion is imparted to lever *T* to cause proportioning or follow-up action of the nozzle. Since it remains stationary, the baffle's slightest movement causes a rapid change in output pressure. This action is identical to an on-off controller's.

To achieve automatic reset, yet preserve stability, we have to throttle valve *R* so air bleeds slowly into bellows *Y* whenever a load change occurs. Thus, the proportioning action of bellows *X* can be retained because any load change causing a baffle movement immediately produces a change in output pressure, and bellows *X* repositions the nozzle accordingly. As air slowly bleeds into *X*, lever *T* is gradually forced to its original position preceding the load shift.

In demonstrating this action, let's adjust valve *R* to admit air gradually to bellows *Y*, Fig. 5. In practice, stability of the process governs this bleed rate; otherwise, a cyclic condition may be set up.

Imposing a 50% load we observe that the pen levels out and holds at the 50 mark. Suppose we change the load to 75%. Pen swings about 20 chart units to right of control band, stops, and as the reset action continues to function, slowly returns to the control point. Controller has thus compensated for a load change. If the load is now returned to 50% the pen swings about 20 units to left of control band, then slowly returns to original position.

While the controller now compensates for load changes, its recovery speed is too slow. Increasing the reset rate may help at times but at others a higher reset rate may give unstable control. What we need is an auxiliary device to increase recovery speed without impairing reset or proportional action.

Reviewing the action of the on-off controller we find that any slight motion transmitted to the baffle by the pen causes a rapid change of output pressure. Because of lack of follow-up action by the nozzle, a minute movement of the baffle caused an instantaneous change in nozzle backpressure. If this action can be incorporated in our proportional system, response rate of the controller is greatly accelerated.

Slowing Follow-up Action. Evidently, nozzle follow-up cannot be entirely eliminated if proportional response is to be retained. But if nozzle movement is momentarily interrupted as the baffle assumes a new position, output from the controller momentarily changes at a rapid rate. If follow-up action could then be restored, the instrument would again perform as a proportional controller.

Recalling that follow-up is produced by air-pressure impulse delivered to bellows *X*, desired momentary interruption is achieved by installing a restricting needle valve *P* in the air lines feeding bellows *X*, Fig. 5.

Controller now operates thus: A slight pen disturbance causes baffle to change position in relation to nozzle, and thus generate a rapid change in output pressure. Since needle valve *P* restricts air flow, proportional action of bellows *X* is greatly retarded, and this holding back allows output pressure to increase or decrease rapidly. Such acceleration provides the increased rate of controller response we require.

The term *rate response* is generally applied to such controller action. As air continues to bleed through needle valve *P*, the proportioning bellows eventually causes nozzle to assume its correct position in relation to baffle and thus preserve proportional action.

Let's make use of this response by partly closing needle valve *P* and repeating the load change previously shown with proportional plus reset response. Load on the process is set at 50%, throttling range remains at 100%, while reset rate is increased slightly by opening needle valve *R* farther. These three adjustments correspond to the three adjusting knobs on a conventional instrument and are set in accordance with process stability.

Load-Change Action. If we increase the load to 75% the pen swings but four or five chart units away from the control band and quickly returns. Decreasing load to 50% shows the same action in the opposite direction. Deviation from the control band is reduced from 20 units to about five, and recovery time is reduced considerably.

While this test shows an accelerated recovery following an instantaneous load change from 50 to 75%, the majority of processes do not receive such an abrupt upset in actual practice. It is more likely that the load change will occur at a far slower rate. Rate response will assist greatly in stabilizing the control in such cases since it causes

TABLE I—OPERATION WITH LINK SET FOR THROTTLING RANGE OF 100%

Pen position on chart	*Baffle, bellows position, Fig. 7*	*Output and bellows pressure, psig*	*Valve opening, %*
0	A	3	0
25	B	6	25
50	C	9	50
75	D	12	75
100	E	15	100

Note: For every pen position, there is a corresponding position for the nozzle and baffle, a corresponding output pressure and control-valve opening.

TABLE II—STEP-WISE ACTION OF RESET BELLOWS

	Load, %	*Pressure at Y, psig*	*Position lever T*	*Pressure at X, psig*
PROPORTIONAL ACTION ONLY ($TR = 100\%$):				
1. Bellows *Y* charged with air at 9 psi; valve *R* closed	50	9	C	9
2. Load increased to 75%	75	9 plus	D	12
ADDITION OF RESET ACTION:				
3. Valve *R* opened to admit output air (12 psi) to bellows *Y*	75	12	C	12 plus
4. Process reaches new balance and original control point is restored	75	12	C	12

Note: In actual practice, valve *R* is partly opened in order to provide reset action at a rate that is consistent with the stability of the controlled process.

controller output to lead response rate of the process.

That is, if the pen were to move at a fixed rate away from the desired control point and air flow to bellows *X*, Fig. 4, were restricted by needle valve *P*, rate of follow-up motion would be retarded and the nozzle displaced from its normal relationship with the baffle. Consequently, output pressure would be accelerated in relation to pen motion. Accelerated output thus obtained has great value in offsetting the ill effects caused by time lag in the process and measuring element.

To produce the greatest effect, the process would be arranged to incorporate time lag, such as is imposed by the restricting valve between the tanks in Fig. 3. Then using a motor-driven loading valve to change the system load gradually, improvement in control due to rate response could be vividly demonstrated by alternately opening and throttling valve *P*.

When valve *P* throttles air to bellows *X*, controller output changes rapidly and causes control valve to supply excess water to left-hand tank, which increases its level, and thereby assists in overcoming resistance to flow offered by the *time-lag* restriction valve in the process. Without rate response, controller output appears sluggish and the process reaches an unstable condition because the instrument cannot send an advance impulse to control valve to offset time lag.

Finished Design. Our controller is now fully equipped with the three adjustable responses and the instrument is essentially the same as a conventional pneumatic controller. It contains the same elements and operates on identical basic principles but each manufacturer uses a slightly different mechanical design for adjustments.

Mechanism to adjust throttling range may be a simple arrangement of pivots and levers or a complicated assembly. Reset action may be accomplished by two opposing bellows or by applying the opposing pressures inside and outside a single bellows. Flow to bellows may be throttled by special needle valves, restricting tubes, or a unit containing variable passageways.

Next step is to design a mechanism that detects and corrects improper position of the control-valve stem. But we must avoid complicated mechanisms because the device may be installed on a valve in a corrosive atmosphere or where space is limited.

Valve Positioner. Suppose the valve stem travels one-half inch as diaphragm pressure is increased from 3 to 15 psi. If an accuracy of 1% is required, the stem must stay within 0.005 in. of desired setting. Such close adjustment requires a sensitive "feeler" device to detect variations of this magnitude. Let's try a nozzle-baffle system as the "feeler," Fig. 6.

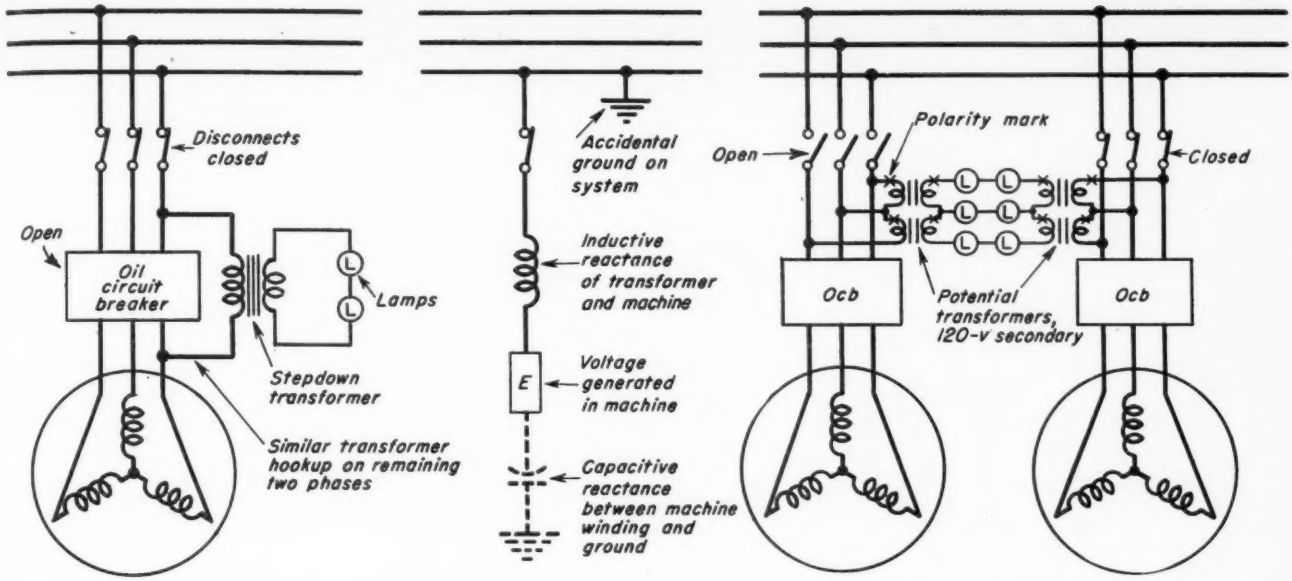
Mounted on right of valve frame is a bellows *A* opposed by a range spring *B*. This assembly, a duplicate of the follow-up unit in the proportional controller, is designed so air-pressure change from 3 to 15 psi causes the bellows to expand one-half inch. A nozzle, *C*, is attached to a plate mounted between bellows and spring. As bellows expands or contracts, plate and nozzle move to a position proportional to the air pressure within bellows. An air-supply connection, upper right in sketch, feeds air to a restriction *R* and thence to nozzle through a length of flexible tubing. A branch from the nozzle line is connected to diaphragm.

Remember that this same scheme, used in the on-off controller, can detect a baffle movement of thousandths of an inch. So that valve-stem position may become a function of nozzle position, a baffle *D* is mounted on a collar attached to the valve stem. Once the baffle is adjusted to a definite clearance with the nozzle, any motion of the nozzle causes a change in backpressure and thereby increases or decreases the air pressure transmitted to the diaphragm top.

Suppose the controller supplies an impulse of 9 psi to bellows *A*, and correct valve-stem position for this pressure is midstroke. As the nozzle assumes the new position dictated by the bellows, baffle is manually adjusted by sliding the collar on the stem until the baffle restricts nozzle outflow enough to create a 9-psi backpressure. As the diaphragm receives this impulse it moves valve stem downward to midpoint of travel. Baffle support collar should now be locked to the valve stem since the mechanism is in proper alignment.

If valve friction prevents free stem movement, baffle movement would be temporarily retarded, nozzle would continue to approach baffle, and resulting back pressure on diaphragm top would increase to full output pressure, or until the force was enough to overcome friction. Accuracy of valve response has now been improved to equal that of the controller.

Considerable credit is due John H Kowalski for ingenuity and expert workmanship in building the panel. The author also expresses his thanks to R L Clarke, F C Kiesling, N F Koenig, E W Jensen, R C Mack and Miss D E Warren for suggestions in preparing the demonstration.



HOOKING TRANSFORMERS across each phase of open oil circuit breaker is usually OK for phase-out test. Because of ground on one feeder phase, resonant condition was approached with resulting large current flow. Finished job with hookup C

Ground Halts Generator Phase Test

One of several methods may be used in phasing-out a new ac generator. E J Kelley, of Kansas City, Mo., picked the one shown in A and ran into a resonant circuit condition

▶ PHASING OUT a new ac generator in a small plant is ordinarily a routine job. Although it requires care it does not as a rule present any particular problem. One method that is often used is shown in sketch *A*.

Phasing-Out Procedure. Using the hookup in *A*, with oil circuit breaker open, machine is brought up to speed and proper voltage. Disconnect switches are then closed. Phase rotation of new machine is OK if lamps, connected in transformer secondary, all grow bright and dim together. When lamps in each phase light and go dark alternately, phase rotation of new machine is incorrect. In this case it's necessary to interchange two of the machine leads. This is usually done at the ocb.

Some years ago we had an experience that was distinctly out of the ordinary. Using this same hookup, with machine up to speed and voltage about normal, we found one of the disconnects had not closed properly. With machine still running, the disconnect was opened. We received quite a surprise when a heavy arc broke, which indicated a large current flow. On opening each of remaining phases we noted the same condition. Our first thought was low insulation resistance in machine winding or leads. After megohmmeter tests showed everything clear, we went ahead and took another crack at phasing out.

On the third attempt lamps, connected across transformer secondary, followed no regular pattern in going bright and dark. We noted that lamps, when lit, were abnormally bright. With one set exceptionally bright, the others would only glow.

Ground On System. None of this disturbance seemed to follow the book of rules so we looked for trouble outside the machine proper. Our first clew came when we noticed the ground detector on the operator's board indicated a ground on one of the feeders. Since the system was ordinarily ungrounded we drew a few mental connections and decided this ground was the seat of our trouble.

Referring to sketch *B*, it was evident that the grounded phase, primary of transformer and capacitance between machine winding and ground, was forming a series resonant, or partially resonant, circuit. Capacitance of machine's winding to ground may be represented as a wye-connected set of capacitors. Under normal conditions the voltage across each capacitor would be the phase or line-to-neutral voltage. But with a ground on one phase external to machine, voltage across that capacitor would be zero. Voltage across each of remaining condensers would then be the line-to-line voltage.

By applying this theory to the condition at hand, the large current flow can be explained. If circuit were in pure resonance, the only opposition to current flow would be the resistance; in most installations of any size this opposition is of negligible value. The pure resonant condition would occur if the machine's capacitive reactance and the inductive reactance of transformer and machine were equal. If such a condition exists it is possible to have the voltage across transformer and that between machine and ground exceed the applied voltage. Under that condition the only opposition to current flow would be pure resistance of the series circuit.

Since the fault was not cleared promptly we went ahead with our work using a hookup shown in sketch *C*. This method is used widely in many plants for phasing out as well as synchronizing.

SPEAKING OF POWER

The "thickened" fuel that made flamethrowers and incendiary bombs more effective is now going to work for the power engineer. As a fuel igniter, it will bring a stoker, without kindling, from cold to operating steam pressure in half an hour. Developed by Esso for a large utility, the fuel igniter—diesel oil brought to a jellylike consistency with an aluminum soap—is expected to find wide use in the power-plant and railroad fields.

★ ★ ★

Any engineer who has ever checked grate bars or stoker iron, exposed to high temperatures for long periods, knows that cast iron has an annoying property known, logically enough, as "growth." Now along come metallurgists of Battelle Memorial Institute with a cast iron that does not warp or change dimensions when heated repeatedly to high temperature. This growth-resistant cast iron is high in silicon; minor amounts of copper and chromium are added in casting to make it oxidation resistant at high temperature.

★ ★ ★

As the first cold days bring thoughts of winter, cautious optimism prevails with respect to the fuel-oil situation. Demand looks to be about 7% higher than last year, but, if all goes well, supply should meet it. Remember, however, that availability of fuel oil in any specific area depends on transportation and storage. It's a good idea to figure there will be "spot" shortages this winter as there were last, though probably fewer, and act accordingly.

★ ★ ★

Facing a power-supply deficit during industrial working hours in winter months, Cleveland Electric Illuminating Co hopes to balance supply and demand through a cooperative load-shift program. Asked to help are 350 large users (200-kw demand and over): their share—reducing load 15% during working hours by shifting part of operations to other hours or weekends. For its part, CEICO will (1) hold controllable power use in its own plants to off-peak hours (2) by agreement, reduce load of two largest industrial customers on short notice, when necessary (3) reduce voltage to extent practicable. Meanwhile CEICO presses a 330,000-kw construction program.

★ ★ ★

Widely hailed as a revolutionary advance, continuous casting of steel has been announced jointly by Republic Steel Corp and Babcock & Wilcox Tube Co. In conventional steelmaking, the open-hearth furnace converts pig iron to steel, which is poured into ingot molds. After soaking, ingots are stripped, cleaned, and reduced by rolling to blooms, billets and other secondary shapes ready for further fabrication into finished products Eliminating some of the costliest and most cumbersome mill equipment, the new method takes molten steel from the open hearth, and, in one continuous operation, forms billets, cools and cuts them to any desired length, ready for secondary fabrication. Savings of at least $3.00 per ton are expected, with higher production.

★ ★ ★

Productivity continues to rise as our coal mines are more completely mechanized. Latest figures (1947) show that almost 60% of coal mined underground is mechanically loaded. This is one reason a U. S. miner can produce 5.2 tons of bituminous per shift, against 1.2 tons over the same period for his less well-equipped British counterpart.

Researchers of Sinclair Refining Co have discovered a rust inhibitor of such effectiveness and stability that less than three gallons added to 1000 bbl of a petroleum product at the refinery will provide protection to the point of final use. The material, known as RD-119, creates on metal surfaces an invisible polymolecular protective layer which prevents contact with air and moisture. Developed to protect pipelines against corrosion from petroleum products flowing through them, the lasting qualities of this inhibitor will provide the same protection for the customer's storage tanks, piping and oil-using equipment. It is expected that RD-119 will be licensed to other oil companies.

★ ★ ★

E A Roberts, of Carlsbad, N. M. tells about being called in by the local banker to have a look at the motor-driven adding machine back when such contrivances were new. Although they kept books for years in the old-fashioned way, the bookkeepers were now dependent on the machine. Against E A's better judgment, he was talked into trying to fix the machine to save the time it would take to send to headquarters for a service man. His doubts about his ability to fix such a complex device were relieved somewhat by the ease with which he was able to remove the cover and expose the working parts. But his newfound confidence took a thudding dive when he ran across a sign that said, with obvious aptness, "DO NOT ALLOW THE VILLAGE TINKERER TO GO IN HERE WITH A SCREWDRIVER" . . .

Service

You touch the switch and the light comes on
With never a wink's delay
The filament glows and the darkening room
Is lighted as bright as day.

This is the stuff that can't be stored
It has to be made right now
This instant men and machines must work
For you, somewhere, somehow.

You need not know and you may not care
The "why" of the switch you flip
But the work of a thousand men is there
right at your finger tip.

Not helter-skelter nor hit-and-miss
But timed to so true a pace
That your clock keeps time as the very stars
Right there on your mantel place.

The power plant's work is little or big
As your use is great or small
But it's always there to serve your need
At a touch of the switch on the wall.

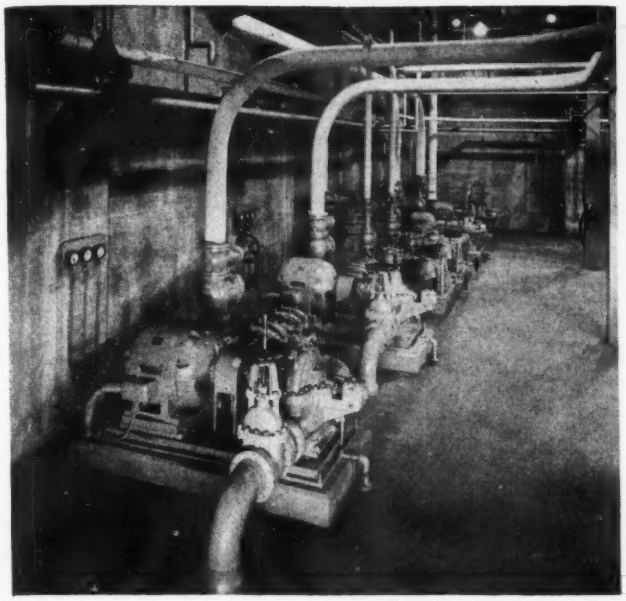
R S CLARK

THIS MONTH'S COVER

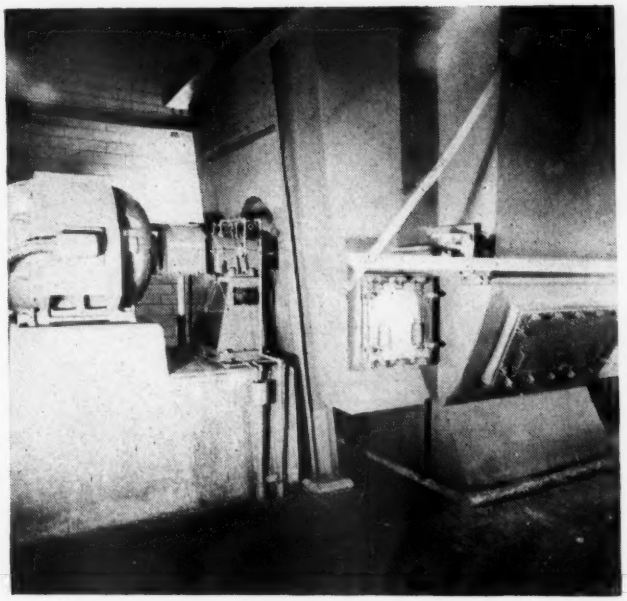
This interesting pattern of tubes caught McGraw-Hill photographer Syd Karson's eye in the course of a POWER assignment at the Jacob Ruppert brewery in New York. He took the picture, left it to the editors to say just what his camera had recorded. Here's the dope:

The operator is inspecting the water-inlet end of four large vertical shell-and-tube ammonia condensers, part of the brewery's large refrigeration plant. The stub tubes shown (one in operator's hand) insert in the long "working" tubes of the condenser at the tube sheet, which is about a foot below the top of the shell. These stub tubes are perforated near the bottom to guide and distribute cooling water to the interior of the main tubes.

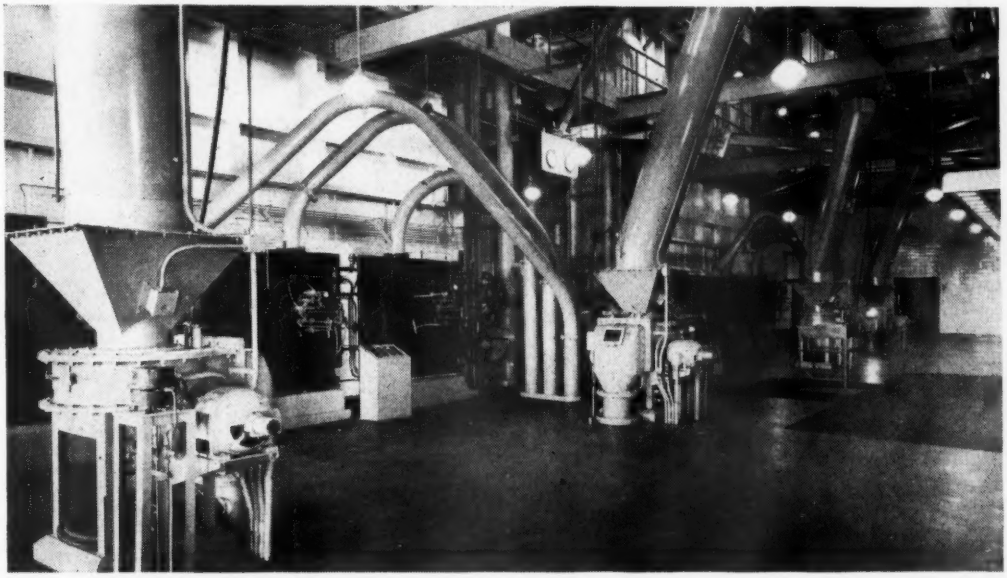
Crawford Station Unit No. 3 Continued from page 67



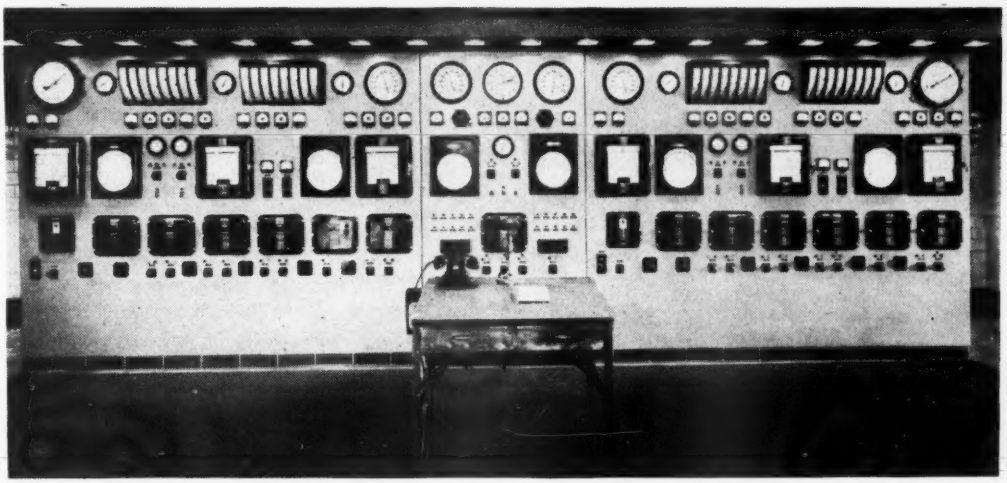
AUXILIARY PUMPS FOR ASH SLUICING, screen washing and house service are concentrated at one point in plant basement



ONE MOTOR-DRIVEN INDUCED-DRAFT FAN, located on upper level, serves each steam generator. Vanes control gas flow



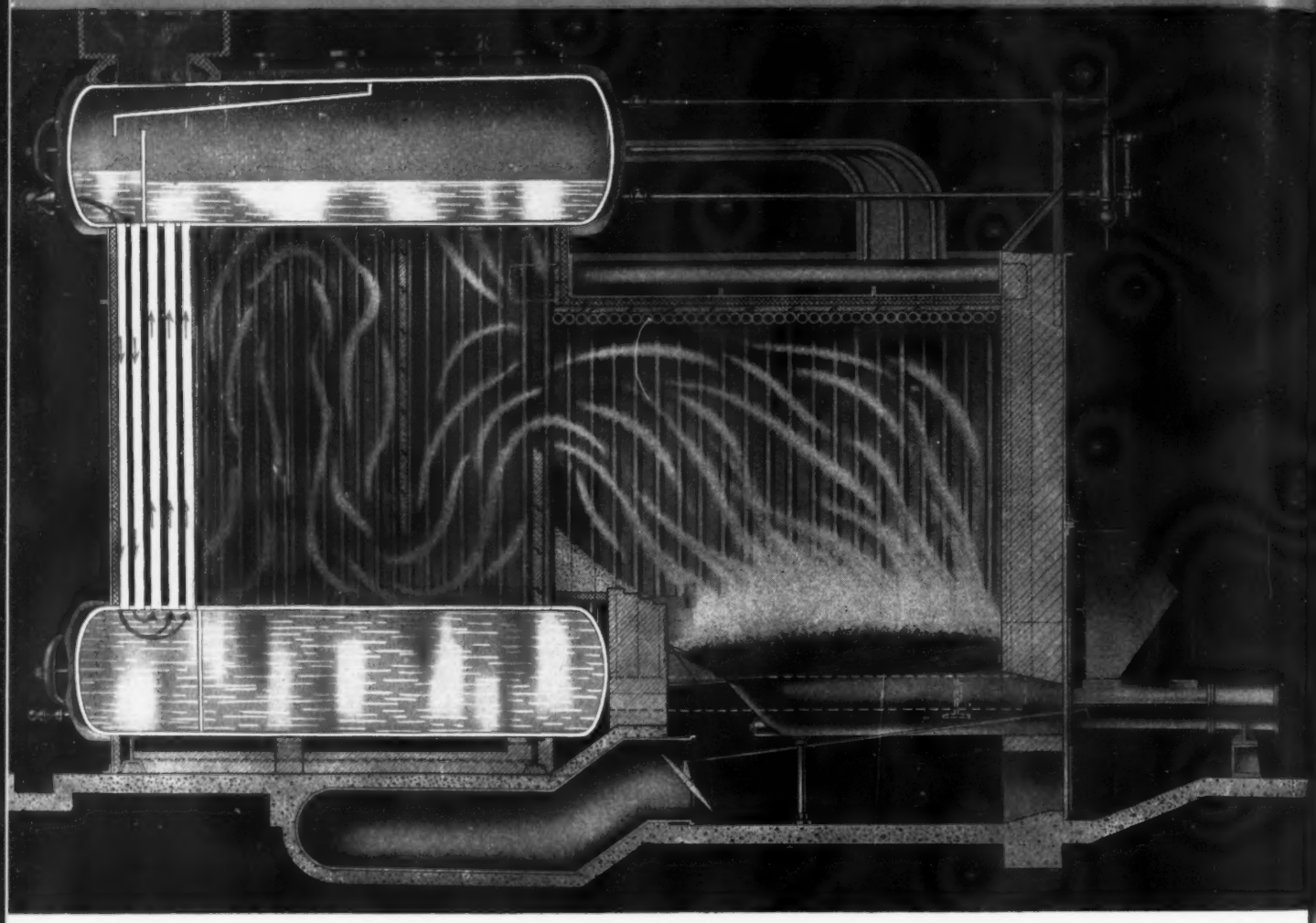
PULVERIZER COAL FEEDERS are on operating floor. Each boiler has 3 burners in back and front walls



BOILER CONTROL PANEL for boilers No. 7 and 8 faces pulverizer feeders shown in picture above

Continued on page 98

Only with Riley "RO" Boiler Units



In no other moderate size boiler unit can you get all of the outstanding advantages found in the Riley "RO" boiler unit. All of these advantages are well worth their costs and pay users handsome dividends in lower steam costs, lower maintenance and trouble-free continuity of operation. Riley "RO" boiler units are built to the same high standards as large central station units.

Integral Economizer

Assures low flue gas temperatures and higher efficiency

Riley "RO" boilers are equipped with a patented economizer section located at the rear of the unit and as an integral part of it. The use of this integral economizer adds appreciably to the actual operating efficiency by more efficiently utilizing the heat of the gases, thereby reducing the heat loss up the stack.

Water-cooled Furnace

Permits high combustion efficiency and low furnace maintenance

Water-cooled furnaces are used to permit high combustion efficiency by reducing furnace temperatures; to minimize difficulties with clinkers and slag; and to give low furnace maintenance. All larger steam generating units use water-cooled furnaces. The same advantages occur from their use on moderate sized units. Riley uses 3¼" O.D. tubes for water walls.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs.

RILEY

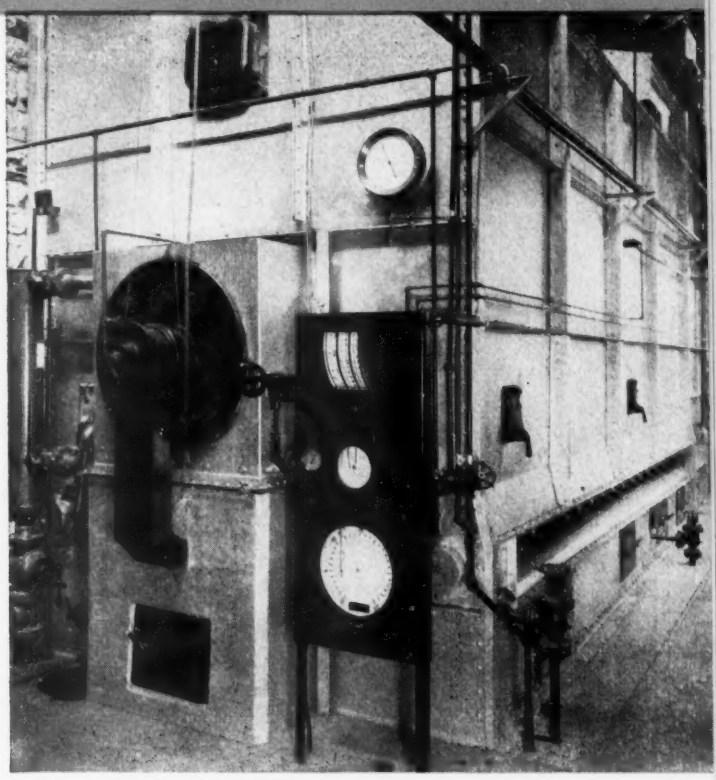
STOKER CORPORATION, Worcester, Mass.

Boston New York Philadelphia Pittsburgh Buffalo Cleveland Detroit
St. Louis Cincinnati Houston Chicago Denver Memphis St. Paul
Kansas City Los Angeles Atlanta New Orleans Washington Seattle Tulsa

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • AIR HEATERS
SUPERHEATERS • ECONOMIZERS • WATER-COOLED FURNACES
STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

do you get all of these advantages



Forged Hand Hole Covers

Provide ready access to water wall headers from outside of unit

Large diameter water wall headers equipped with forged hand hole covers are used with Riley "RO" boilers. These hand hole covers provide ready access to every water wall tube from outside the setting. Did you ever hear of a large steam generating unit where water wall headers were not equipped with hand hole covers?

Rugged Steel Casing

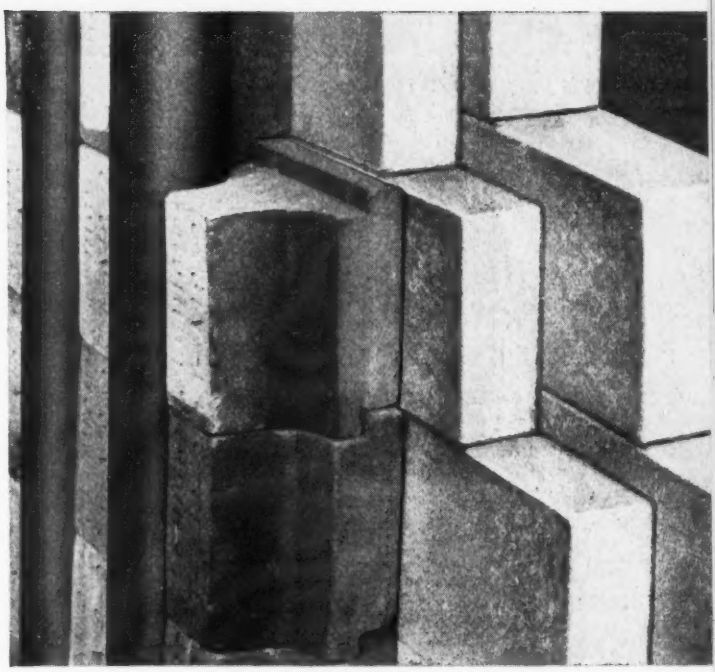
Reinforced No. 10 gauge casing assures permanent tightness

The steel casing used with Riley "RO" boilers is No. 10 gauge and heavily reinforced to assure permanent air tightness and rigidity, practically eliminating air infiltration. It is not just a tin covering for appearance alone.

Insulated Tile Setting

Minimizes radiation loss

Riley "RO" settings are heavily insulated with high temperature insulating blocks and mineral wool felt to give low outside casing temperatures and to reduce radiation loss to a minimum.

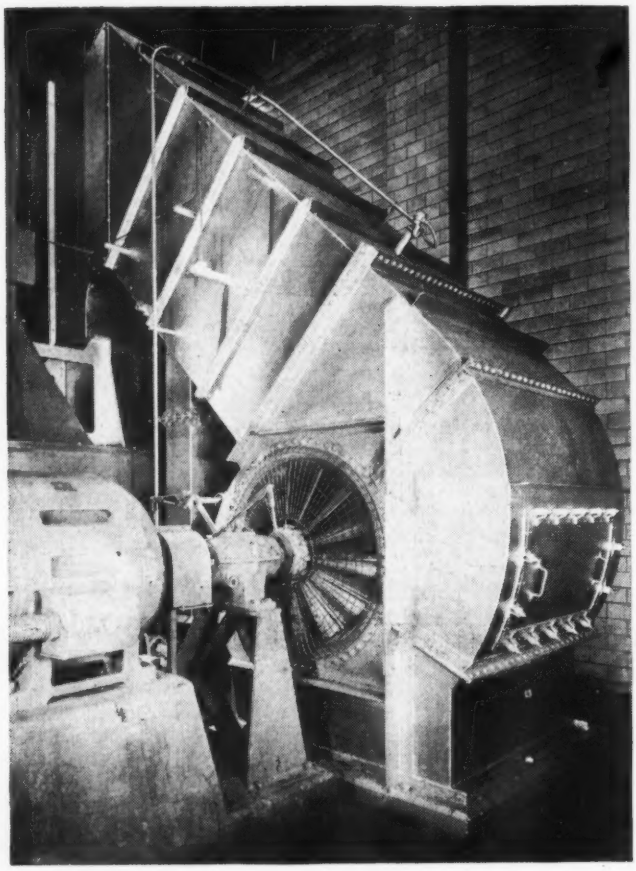


All of these well-known companies have installed Riley "RO" Boilers

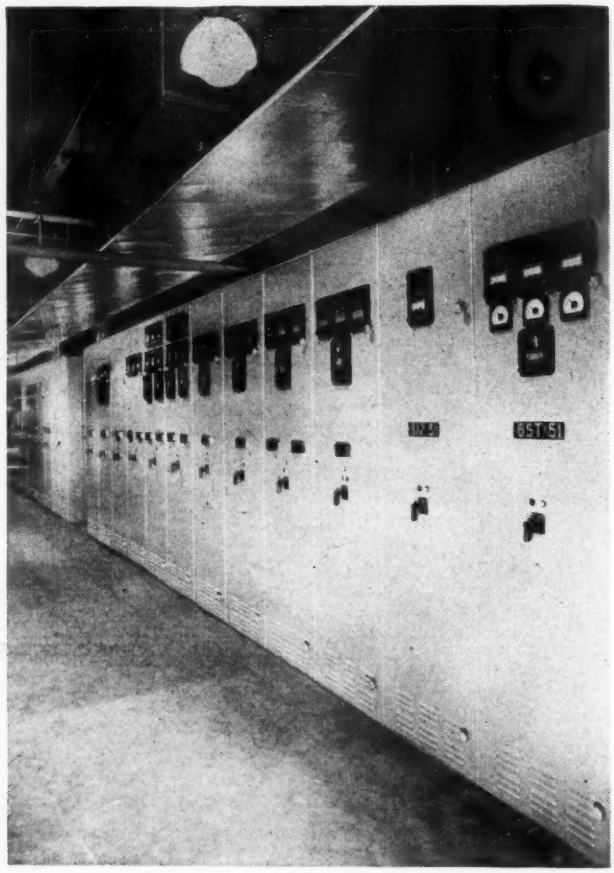
American Brass Co.
Monsanto Chemical Co.
Packard Motor Car Co.
Goodyear Tire & Rubber Co.
Standard Oil Co. of Calif.
American Steel & Wire Co.
General Electric Co.
Nicholson File Co.
Owens Corning Fiberglas Co.
Pepsi-Cola Co.
Scovill Mfg. Co.
Boeing Aircraft Co.
Bullard Company
Westinghouse Electric Co.
Pet Milk Co.
Chrysler Corp.
New Departure Bearing
Industrial Rayon
Hercules Powder Co.
Pullman-Standard Car Co.
Revere Copper & Brass Co.
U.S. Gypsum Co.
Republic Creosoting Co.
Armour & Co.
Celanese Corp. of America
Mead Corp.
Park & Tilford, Inc.
Pennsylvania Salt Co.
A. O. Smith Co.
Congoleum Nairn Co.
Nunn Bush Shoe Co.
Curtis Wright Corp.
Eagle-Picher Lead Co.
Publicker Industries
General Analine Works
Public Service Elec. & Gas Co.
General Motors Corp.
Belding Heminway Co.
Heyden Chemical Co.
Chas. H. Phillips Chemical Co.
Perfect Circle Co.
J. Wiss & Sons
C. G. Conn Co.
Behr Manning Co.
Central Ohio Light & Power Co.
General Food Co.

Crawford Station Unit No. 3

Continued from page 95



ONE MOTOR-DRIVEN FORCED-DRAFT FAN, located on upper level, serves each steam generator. Vanes control air flow



2300-VOLT SWITCHGEAR for electrically driven boiler-room auxiliaries has protecting canopy against overhead leaks

PRINCIPAL POWER-PLANT EQUIPMENT

Units No. 3 and 4, Crawford Station, Middletown, Pa., Metropolitan Edison Co

STEAM GENERATORS NO. 7 AND 8:

Boilers, 2 ..... Foster Wheeler Corp
250,000 lb per hr each, 875 psig, 910 F, pulverized-coal-fired, 3-drum, dry bottom, waterwalls
Superheaters, 2 ..... Foster Wheeler Corp
7170 sq ft each, superheat control by condensers in saturated steam header, two section, nondrainable
Economizers, 2, 8640 sq ft each ..... Foster Wheeler Corp
Air heaters, 2 ..... The Air Preheater Corp
43,000 sq ft each, regenerative
Pulverizers, 4 ..... Foster Wheeler Corp
Hardinge type, each feeds 3 burners, 6 burners per boiler arranged for opposed firing
Forced-draft fans, 2 ..... Sturtevant Div, Westinghouse
Motor driven, vane controlled
Induced-draft fans, 2 ..... Sturtevant Div, Westinghouse
Two-motor drive, 250 hp at 720 rpm, and 500 hp at 900 rpm, vane controlled
Tempering air fan, 2 ..... Sturtevant Div, Westinghouse
Flyash precipitators, 2 electrostatic ..... Research Corp
Ducts and breeching ..... Connery Construction Co
Chimney, 1 concrete ..... Rust Engineering Co
Coal-handling equipment ..... Link-Belt Co
Ash-handling equipment ..... The Allen-Sherman-Hoff Co
Combustion-control equipment ..... Leeds & Northrup Co

TURBINE-GENERATOR UNITS NO. 3 AND 4:

Turbine-generator, 1 ..... General Electric Co
35,000 kw nominal, 43,750 kw maximum, 850 psig, 900 F, 3600 rpm 4 bleed points, hydrogen-cooled generator
Turbine generator, 1 ..... General Electric Co
3000 kw nominal, 3750 kw maximum, 850-psig 900-F throttle steam, 330-psig backpressure at 705 F, 3600 rpm
Main condenser, 1 ..... The Lummus Co
Surface type, 34,000 sq ft, 2-pass, Admiralty tubes
Circulating pumps, 2, motor driven ..... Ingersoll-Rand Co

CONDENSATE AND FEEDWATER SYSTEM:

Condensate pumps, 2, motor driven ..... Ingersoll-Rand Co
Closed feedwater heaters, 4 ..... The Lummus Co
Deaerating heater, 1 ..... Elliott Co
Evaporators, 2 ..... The Griscom-Russell Co
Boiler feed pumps, 3 ..... Pennsylvania Pump & Compressor Co
Two, motor driven, one dual driven with clutch-type coupling to turbine drive, solid coupling to motor
Boiler feed pump turbine, 1 ..... The Terry Steam Turbine Co
Major steel valves ..... Reading, Pratt & Cady Div
Feedwater regulators ..... The Northern Equipment Co

MISCELLANEOUS EQUIPMENT:

Desuperheating station ..... Republic Flow Meters Co
Desuperheating pump ..... The Aldrich Pump Co
Pipe fabrication ..... Benjamin F Shaw Co
Insulation ..... Johns-Manville Co
Automatic trash rake ..... The Link Belt Co
Traveling screens ..... Chain Belt Co
Chlorination equipment ..... Wallace & Tiernan
Water softeners ..... Permutit Co
Gravity filters ..... Permutit Co
Water precipitator ..... Permutit Co
Tanks ..... Tippett & Wood
Control-air compressors ..... Pennsylvania Pump & Compressor Co
Flow meters, pressure recorders ..... Penn Industrial Instrument Co
Draft gages ..... Republic Flow Meters Co

General contractor ..... L. H. Focht & Son, Inc
Engineers ..... Gilbert Associates, Inc

"Give us the tools..."

TO SURVIVE

America Must Have Better Tools

IN THE past twenty years the United States has failed to provide its workers with enough new tools and equipment.

To most Americans this statement will come as a shock—or will be doubted. We are quite complacent about our industrial equipment, for easily understood reasons.

Throughout the '30s we heard continuously the propaganda line that the United States had become a "mature economy." The job of equipping America with industrial plants and tools was said to be largely done.

Now, knowing that industry is spending billions to expand and rebuild its plants, many people assume that the result must be a first-class industrial system.

A further powerful inducement to complacency is the vastly *worse* industrial condition of most of the rest of the world. When Americans look abroad in almost any direction they see shattered plants and equipment. A natural reaction is that we are sitting pretty.

That is a dangerous reaction. Between depression and war, we have failed to build the tools and equipment we need. This condition is dangerous for three reasons:

1. ***From bitter experience we know that national security depends first and foremost on the capacity and readiness of our industrial equipment.***

All of our plans for stabilizing prosperity assume a world at peace. The greatest menace to peace would be an unarmed America, unable or unwilling to keep herself strong and ready for defense—strong in spirit, in resources and in the all-important industrial plant and equipment.

2. *Whether Americans live well—or badly—depends directly on the kind and quality of tools used by American workmen.*

This is true for all workers, and for every worker—from a garage mechanic and his wrenches to a steel mill gang and its rolling equipment. In a monumental study of "America's Needs and Resources" the Twentieth Century Fund found this fact: The improvement in the real income of the American people has more consistently followed the amount of power used in industry than anything else. What the workman worked *with* determined, more than any other factor, the size of his pay envelope, and what it would buy.

3. *Our success in stabilizing prosperity will depend largely on what we do about building new tools and equipment.*

About 30% of our industrial workers are employed in producing tools and equipment. Steady employment for them is essential to our over-all prosperity.

How far have we fallen behind in providing new plants and equipment?

Estimates vary. Here is one rough estimate: If we had built new industrial facilities during 1930-48 at the rate we did in the prosperous '20s, we would have spent at least $100 billion more than actually we did.

To get a better and more complete measure of this deficit, McGraw-Hill is undertaking a survey of American Business' Needs for New Plant and Equipment.

Businessmen all over the nation are being asked to answer questions like this: How much

money would you need to put your plant in first class condition? How much are you planning to spend for new plant and equipment? Where do you expect to raise the money? The results will be reported later in this editorial series. Already the survey shows we have fallen many billions of dollars behind.

Some shortcomings are apparent to everyone. They are revealed in a lot of rickety transportation facilities and in rundown buildings.

Many other deficiencies do not come into general view. They are, for example, the antiquated machines in our plants. Of the privately-owned machine tools in use in 1945—when the last census of metalworking equipment was made by AMERICAN MACHINIST—54% were more than 10 years old. Their average age is higher today.

It is true that in recent years we have hit new highs in total national production. But we have done so by putting far more people to work than ever worked before . . . and by driving equipment to the limit of its waning endurance, sometimes beyond. It has not been done *primarily* in what is by all odds the best way to increase production—to use more and better and more modern tools and equipment.

Haven't we overcome much of this twenty-year deficit by rushing to build new plants since the end of the war?

No. For two clear-cut reasons:

1. The accumulated shortage is tremendous. The total of about $40 billion, which has been spent for industrial plant and equipment since VJ-Day, has not wiped it out.

2. Some key industries have had difficulty in getting the facilities they need. Take steel, for example—the industry that turns out our most basic industrial material. Its needs for new equipment are measured in billions of dollars. To pay for that equipment, it should have *risk capital*—money which people are willing to invest with a risk of losing for the sake of gain. For steel is an up-and-down industry. Earnings on its common stocks inevitably share both ways in those ups-and-downs.

Since the war, steel, in common with most of industry, has been unable to market new common stock successfully. Its outstanding stock is now selling for only about one-half the current net worth of the industry's present assets. With investors willing to pay only 50 cents on the dollar for its facilities, the industry can not readily sell stock to pay for *new* plant and equipment—at higher prices even than the old.

Why can't steel—and other industries—attract people who are willing to risk their money retooling America?

The full answer to that serious question must be left to future editorials in this series, for it involves many things . . . tax reform . . . mobilization of small savings . . . a new respect for corporate profits.

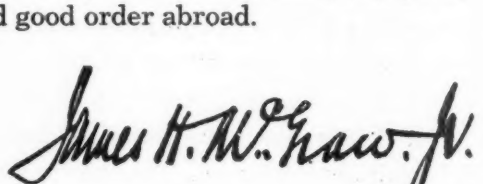
This first editorial seeks simply to emphasize two fundamentals:

First, our standard of living improves with the *quality* of our industrial equipment.

Second, American industry and American workmen badly need billions of dollars worth of better equipment *now*.

The American people must understand that *not only our continued prosperity but also our security as a nation depends upon giving American industry more and better equipment.*

"Give us the tools." This was Winston Churchill's cry for help to win the war. Only if we give American industry new and better tools will we have a chance to win abiding prosperity at home and good order abroad.

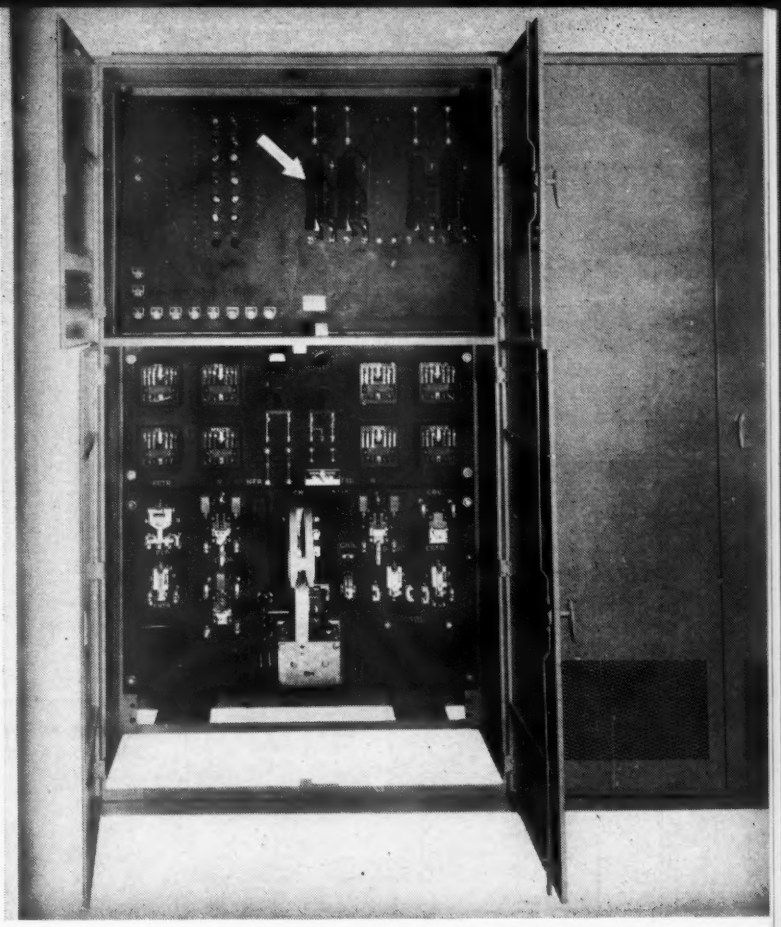


President, McGraw-Hill Publishing Company, Inc.

★ THIS EDITORIAL, and a series to follow, will be devoted to a single problem—how to provide American industry with the equipment needed to improve that envy of the world, the American standard of living. No more important problem confronts us today. Upon our wisdom in handling it depends not only the degree of our prosperity, but also our security as a nation.

THIS IS THE 69TH OF A SERIES

1 Control panel for sectional paper machine with amplidyne exciters located beneath a row of electronic regulators



2 Arrow points to thyratrons used for excitation of motor and generator fields; electronic speed regulator to left

Electronic Control for DC Motors

Exact speed and current-limit control of dc motors is one use for amplidyne generator or thyratron exciter, coupled with an electronic regulator

By G W HEUMANN
Control Engineering Division
General Electric Co

▶ INTRODUCTION OF ELECTRONICS to the power field has meant much in today's advancement in industrial control. Used with electronic tubes, *thyratron* rectifiers and the *amplidyne* generator are finding wide application in controlling speed of dc shunt motors in industrial drives. A thyratron tube is simply a gas-filled rectifier tube with grid control. An amplidyne (amplifying dynamo) is a unique, separately excited dc generator usually driven by a squirrel-cage motor.

There are three common ways to vary speed of a dc shunt motor: (1) changing value of resistance in series with shunt field (2) varying armature voltage while keeping field strength constant (3) combining both methods in a system utilizing armature and field control. For the moment let us consider No. 2, variation of armature voltage. With this method it is customary to get armature-voltage variation by changing field strength of a separate generator used to feed armature of the driving motor. This system, which requires control equipment on a low power level, offers a large degree of flexibility as well as a wide speed range.

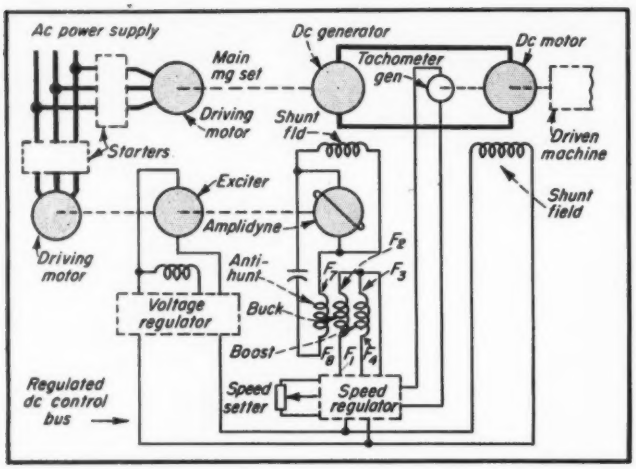
In systems explained in this article, the general aim is to establish desired speed for the driving dc shunt motor and maintain that speed over a wide load range. In such closed-cycle control systems, a *standard* is established that determines the speed to maintain. Against this standard is balanced an electrical impulse that indicates actual speed of drive. Any deviation of actual speed signal from the standard starts corrective action to reduce speed differential.

Speed-Control Needs. The following speed-control systems, singly or in combination, are widely used on industrial drives.

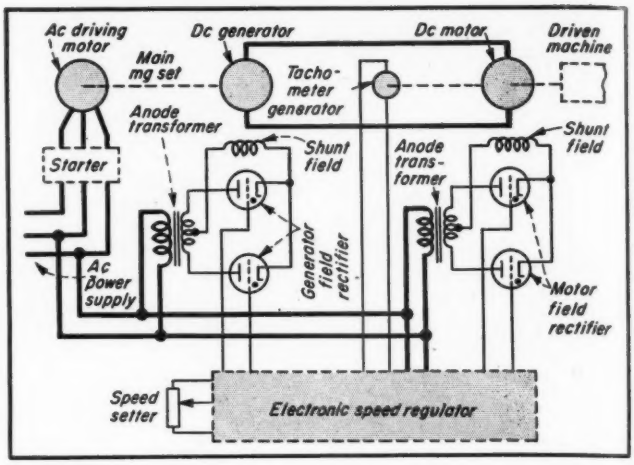
1. Regulation of speed under load. Operator sets manually the desired speed level, which may be adjusted over a wide range. Regardless of changes in load this speed is maintained with small error, often as low as one half of one percent of full-load speed.

2. Program control of speed. Speed setter, which determines the standard, may be varied by automatic means, either as a cyclic function, or as a function of the manufacturing process such as tension of strip being reeled.

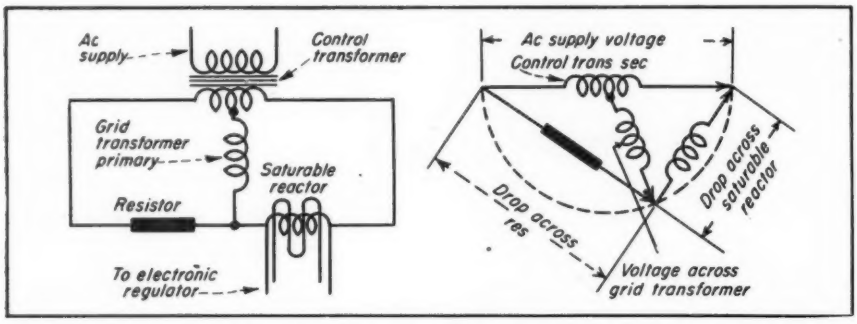
3. Current-limit control. During acceleration and deceleration, armature current must not exceed commutating limit. It is customary to superimpose



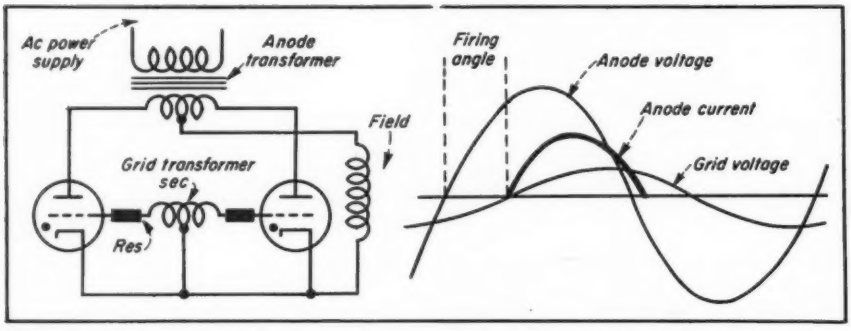
3 Principal circuits of adjustable-voltage-controll system with amplidyne exciter supplying generator shunt field current



4 Thyratron tubes used in both motor and generator fields to rectify ac in addition to adjusting the field strength



7 Phase-shift network for thyratron-tube grid control. Sketch to right shows how value of resistor and reactor vary phase angle of the grid transformer voltage



8 Grid circuit of thyratron rectifier. Varying phase angle of grid voltage, by method shown in Fig. 7, determines value of anode current supplied to field

current-limit control on speed control to limit rate of speed change.

Amplidyne Control. An amplidyne (separately excited dc generator) may be used as regulator, amplifier or exciter. Because of its high speed of response, high amplification and low power level required to excite its control fields, an amplidyne is used for excitation of generator fields in adjustable voltage systems.

Principal circuits of such a system are shown in Fig. 3. An exciter set, consisting of a squirrel-cage driving motor, a constant-voltage exciter and an amplidyne, furnishes regulated dc control power and adjustable excitation for dc generator field. Field of shunt motor driving the load is generally excited at a constant rate.

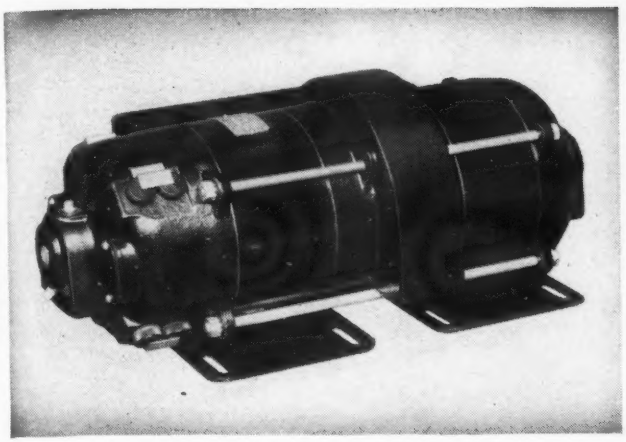
System is able to produce constant torque over a 10 to 1 speed range. By field weakening of shunt motor, an additional 4 to 1 speed range can be obtained.

A tachometer generator coupled to the dc motor measures its actual speed, producing a speed signal in the form of a dc voltage proportional to speed. This speed signal is fed into an electronic speed regulator and compared to a standard established on a speed-setter potentiometer. Any deviation between speed signal and standard acts on the amplidyne fields to effect a change in dc generator voltage.

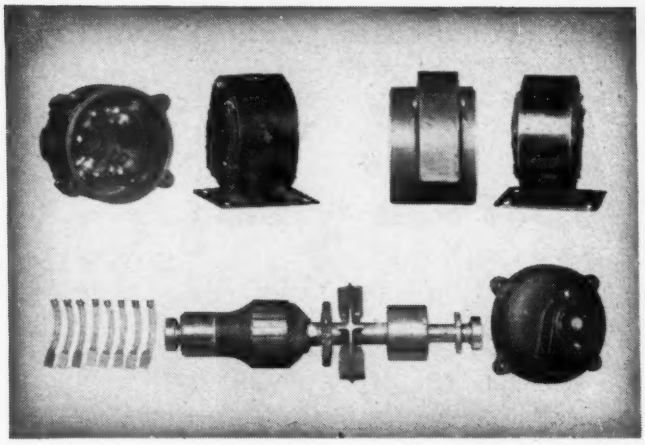
Three fields control amplidyne output voltage: Boost field F_3—F_4 is excited at a constant rate in a direction to raise dc motor speed. Buck fields F_1—F_2 opposes boost field; its excitation is adjusted by regulator. Net difference in magnetomotive force of the two fields determines amplidyne voltage and thus motor speed. Antihunt field F_7—F_8 is connected to amplidyne terminals through a capacitor. Its excitation is proportional to rate of change of amplidyne voltage, and its polarity is such as to oppose any change in amplidyne voltage.

Speed Regulator. One simple form of speed regulator, combining functions of speed and current limit control, is shown in Fig. 9. This regulator contains four high-vacuum tubes forming an electronic amplifier. Only significant control circuits are shown, and for simplicity details such as cathode heaters, screen and suppressor grids and grid feed-back circuits are omitted.

Desired speed is set on a potentiometer-type speed setter connected across regulated dc control bus, 1–2. Tachometer generator voltage is loaded into a resistor and balanced against the standard. Difference between actual speed and the standard determines potential of grid, point 3 of tube 1, and thus amount of current passed by tube 1 and potential of plate, point 4. Disregarding tubes 2 and 3 for the moment, grid point 5 of tube 4 varies as does



5 Wiring terminates in box located on the far side. Combination motor and amplidyne similar to units shown in Fig. 1



6 Same unit as in Fig. 5, disassembled. Amplidyne armature is conventional while field resembles induction motor stator

point 4, thus affecting amount of current passed by tube 4, serving to excite buck field F_1-F_2 of amplidyne. If speed setter is adjusted for higher speed, tachometer voltage no longer balances standard. Point 3 then becomes more positive and tube 1 passes more current. As a result points 4 and 5 become more negative, tube 4 passes less current, and field F_1-F_2 becomes weaker.

This change is followed by a rise in amplidyne voltage increasing dc motor speed until a balance between speed and the standard is reestablished. Tubes 1 and 4 form an amplifier so regulator responds to small deviations between actual speed and standard (such as speed drop due to load) starting corrective action.

Current-Limit Control. Tubes 2 and 3 are used for current-limit control superimposed on speed control. Their control grids are connected to a potentiometer, voltage across being proportional to drop across commutating fields of dc motor and generator. This drop is a measure of the current flowing in dc armature loop circuit, and thus is proportional to load. Screen grids of tubes 2 and 3, through a positive bias applied to them, are so adjusted that with no current flowing in motor armature, tube 2 is turned off and tube 3 is turned on fully.

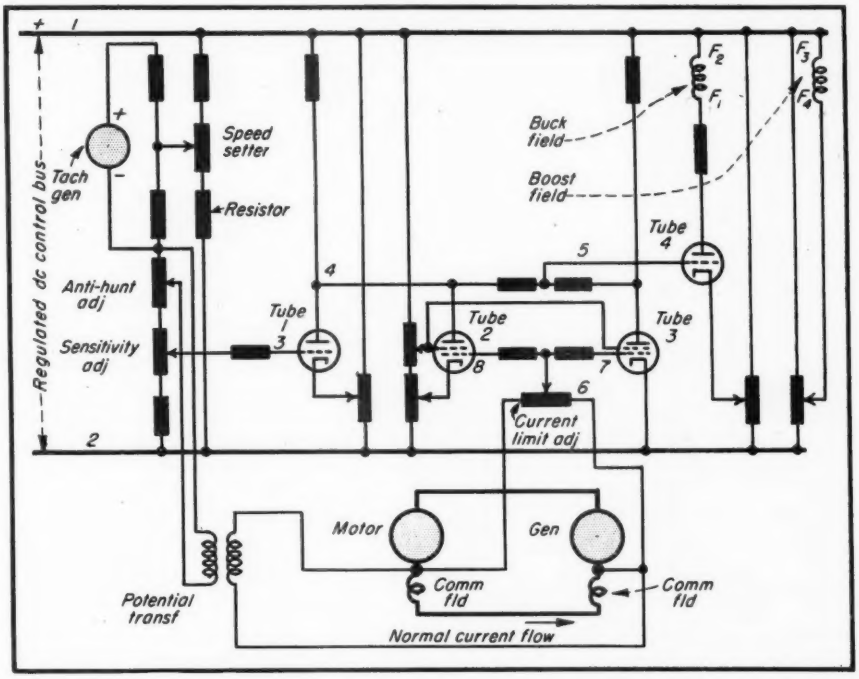
With normal current flowing in loop circuit in direction of arrow, point 6 is negative with respect to point 2. When amount of current in loop circuit during acceleration approaches commutating limit, point 6 and, consequently, grid point 7 of tube 3 become so negative that tube 3 passes less current. Point 5 then becomes more positive and tube 4 passes more current than the speed setter calls for, resulting in motor speed increasing slowly. Thus tube 3 prevents too rapid acceleration. Tube 2 is not affected as it is already turned off.

When speed setter is turned to call for deceleration, current flow in loop circuit reverses, point 6 becoming positive with respect to point 2, and potential of points 7 and 8 rises. This condition has no effect on tube 3, which is already turned on. Tube 2, however, starts conducting when loop circuit current approaches commutating limit and point 5 becomes more negative. Tube 4 then carries less current than speed setter calls for and motor speed is reduced slowly, tube 2 preventing too rapid deceleration.

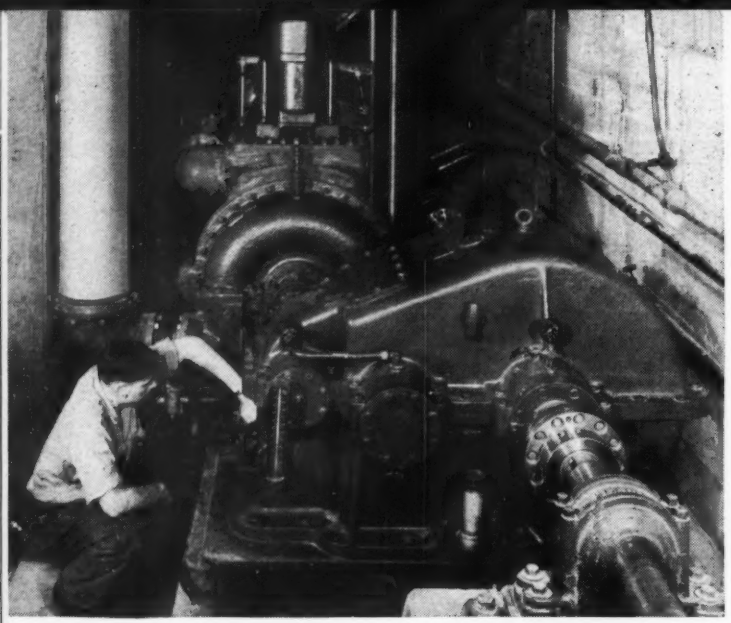
While function of regulator has been described under assumption that manual adjustment of speed setter sets desired speed, it would be possible to introduce program control of speed by operating this setter automatically.

Thyratron Exciters. An all-electric type of speed control has been developed in which thyratron rectifiers replace the exciter set. Fig. 4 shows principal circuits of an adjustable-voltage system

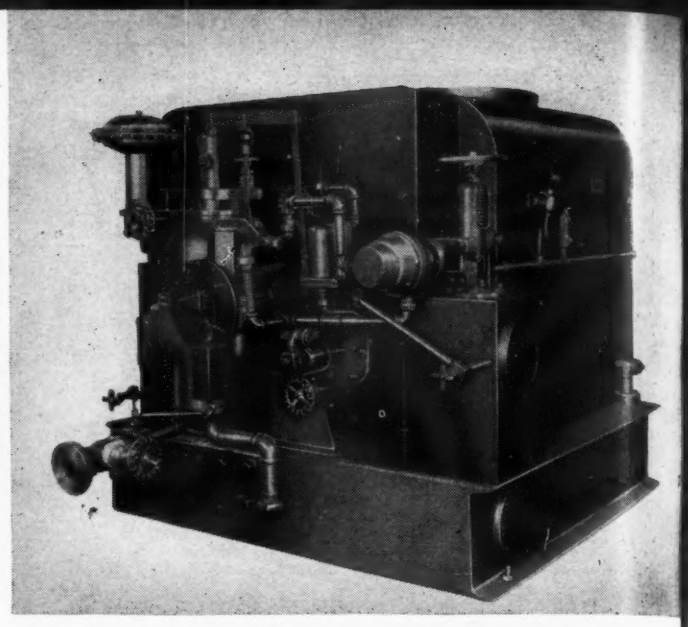
(*Continued on page* 136)



9 Simple regulator combining speed and current limit control. Standard, determined by speed setter, is balanced against voltage from tachometer generator

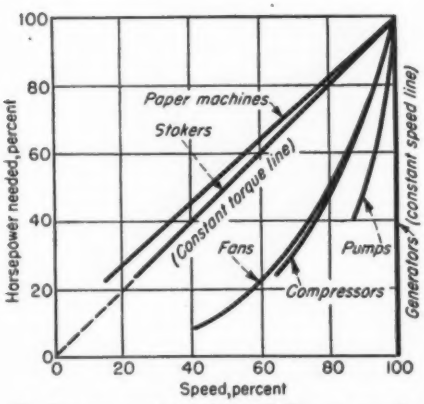


1 For compact arrangements, mechanical-drive turbines can drive several machines through double-end reduction gear

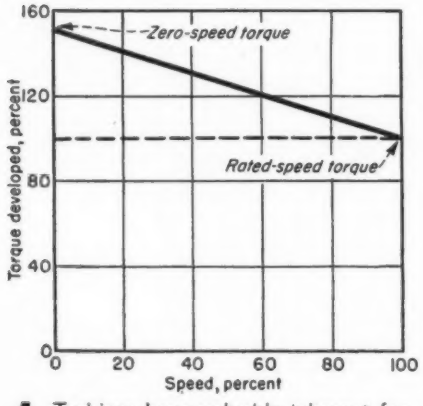


2 Turbine-driving centrifugal compressor has speed controlled by pressure-responsive air motor, upper left corner

Match Mechanical-Drive Turbines To Requirements of the Load



3 Driven machines have different speed-power relationships as shown above



4 Turbines have valuable inherent feature of maximum torque at zero speed

Third and last in a series of articles by F S Kohl, turbine division, General Electric Co, on the selection and application of mechanical-drive turbines in industrial power plants

► WHEN CONSIDERING the purchase of power-driven equipment it is all too easy to analyze the driving and driven machines individually without properly matching the two. As drivers, steam turbines are very flexible and in practically all cases where use of steam proves economical they can be applied with perfect freedom. When specifying a turbine, however, several points concerning the driven equipment should be considered. We will discuss the most important here.

Speed-Power Relation. What is the speed-power characteristic of the driven equipment? Is it constant or variable speed? What are the maximum horsepowers and the corresponding speeds for maximum, normal and minimum operating conditions?

Answers to these questions are essential to the intelligent selection of mechanical-drive turbines. They affect nozzling, governing and lubrication. From experience the turbine designer can make fair assumptions if he knows the nature of the driven equipment. But it is best to cite specific characteristics of each machine.

Speed range over which the unit will operate and the method of control, discussed later, are particularly important as they represent the biggest items that influence governor selection. Specifying an unnecessarily long speed range (except where regulators are applied directly to valves) may demand a more expensive governor and the addition of oil-pump capacity.

Typical speed-power curves for various types of driven equipment (load) are shown in Fig. 3. Curves are not drawn below typical minimum operating points. Usually the speed-power relation shows that torque requirement decreases with speed. An increasing torque characteristic, as shown for paper machines, presents no hardship for the turbine. Ample torque, as shown in Fig. 4, can be developed. The increasing characteristic, however, must be taken into account in selecting coup-

lings and gears as it represents increased loading.

If the driven equipment is other than a "smooth" load care should be taken in describing the torque pulsations encountered. Here again this concerns the coupling and gear rather than the turbine. Reciprocating apparatus should be dampened (by flywheel effect or by shock-absorbing couplings) to the point where torque pulsations reflected to a gear do not exceed about plus or minus 5%.

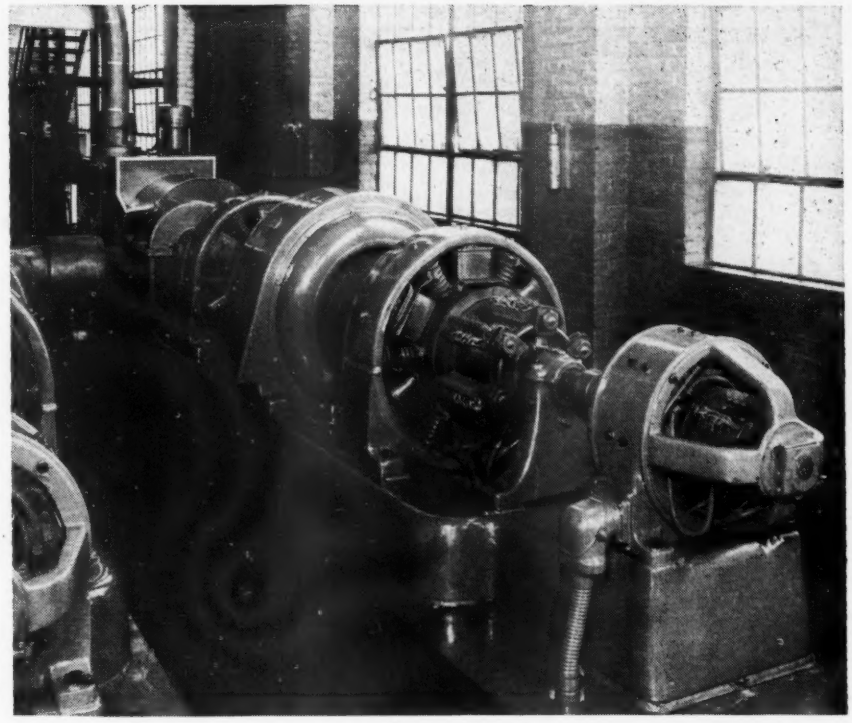
Governing and Control. Method of loading the driven equipment reflects itself directly into the governing system needed on the turbine. It may be helpful to look at "loading" as being done by either of two methods:

1. Decreasing the "resistance" to the output of the driven machine.
2. Increasing the output "pressure" of the driven machine.

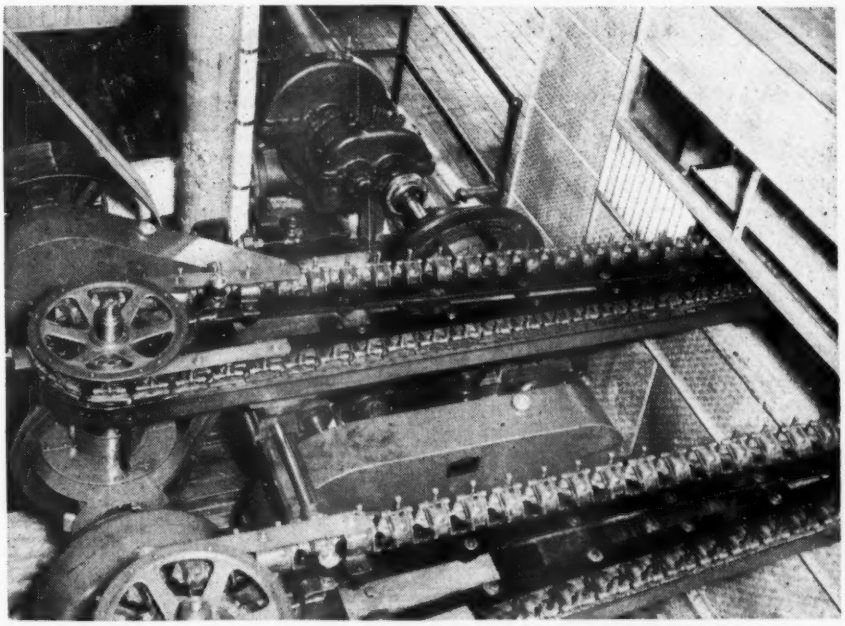
Under Method 1, illustrated by throttling the suction or discharge of fans, compressors and pumps, the driven equipment operates at essentially constant speed. Under Method 2, variable speed is generally used as increased speed usually means increased "pressure."

Variable-speed control on turbines for pumps, fans, compressors and stokers has become increasingly popular during recent years because of the greater use of automatic control systems in boiler plants and for process control. The increased efficiency and ease of control obtained by variable-speed operation is available at nominal cost. This is particularly true for small turbines normally equipped with governors, having only limited speed adjustment, as pressure-responsive regulators. When applied either to the turbine valve or to a separate controlling valve in the steam-inlet line, they eliminate the necessity of using the more expensive long-range speed governors.

Such a regulator consists of a master device that transmits a signal (usually air pressure) related to the variable factor being controlled and an operating element (usually an air motor). The air motor incorporated in the control system sets either speed or valve position. By so doing, control in terms of almost any related signal can be accomplished readily. Such signals as discharge pressure, differential pressure, combustion requirements and temperatures are common. Fig. 2 shows an air motor mounted on a turbine used for driving a high-speed centrifugal compressor. Control was effected in terms of discharge pressure produced by high-speed centrifugal compressor.



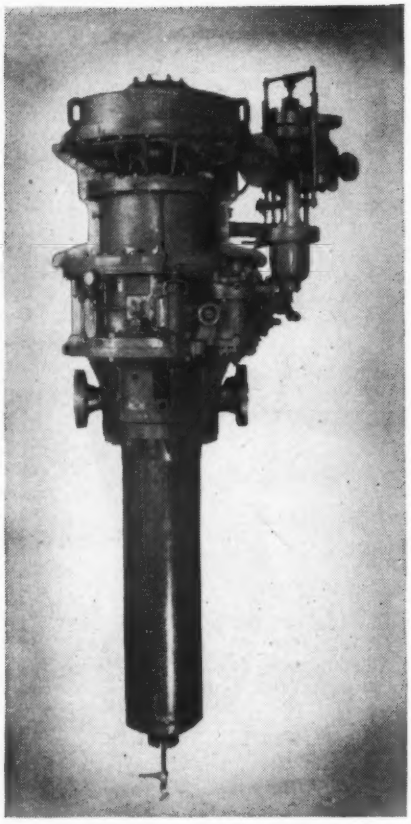
5 Mechanical-drive turbines are often used to run several electrical generators simultaneously on one common shaft through suitable speed-reducing gearing



6 Turbine at upper center operates both the chain drives below and generator, seen beneath upper chain drive, through reduction gears to synchronize speeds

Accuracy of speed control is a question of relatively minor importance on most mechanical-drive applications. The simpler forms of governors, mechanical shaft, direct-acting oil, and pressure relayed types, are adequate in this respect for most fans and pumps, blowers, stokers, etc.

Refined governors of high accuracy and rapid response using oil relayed or electrical systems are normally needed for turbines driving paralleled generators, paralleled compressors, paper machines and textile ranges. Mechanical-drive turbines for both, or either, large-rating and high-steam conditions usually have oil-relayed governors, not because of accuracy of control but to provide adequate force for handling the steam-



7 Vertical turbines are designed for use where the floor space is limited

COMMON PROTECTIVE TURBINE-CONTROL DEVICES

Low-oil-pressure trip—shuts unit down, actuated by low bearing- or control-oil pressure on the driven machine

Solenoid trip—shuts unit down, actuated by electrical signal from any desired source (either pushbutton or relay)

Excess backpressure trip—shuts unit down before blowing of relief valves. Causes for excess backpressure are: closed exhaust valve, low demand for exhaust steam, or loss of condenser water

Circuit-breaker trip—opens breaker of dc generator should the inlet emergency valve trip closed for any reason (otherwise unit might motor and overspeed seriously)

Governor transfer device—automatically transfers from backpressure to speed governing

Quick-starting valve—usually a solenoid-operated valve for automatically starting a standby or emergency unit. Often actuated by loss of voltage to motors or by pressure loss from pumps

governing valves. Standby or emergency generator sets, or those running isolated and used for simple loads where accurate frequency control is not important. can sometimes be controlled by the simpler governors. When specifying such governing, however, one should clearly understand that the frequency will vary appreciably because of the broader regulation, lower accuracy and slower response. Generator sets over 150-kw capacity are seldom used in applications allowing other than oil-relayed governors for control of shaft speed.

For turbines driving mechanical units such as paper machines and textile ranges, whose speed is set by an operator remote from the turbine, motor-operated speed changers should be specified. Speed can then be set by remote pushbutton control. Governors can also be arranged to bring turbine speed to specified values by pushbutton action, usually termed "preset speed" control.

Protective Devices. Most turbines are equipped with an emergency governor for protection against overspeed. These usually operate at speeds from 10 to 20% over maximum operating speed. Relief valves are usually installed in the exhaust line between the turbine and the first shutoff valve as protection against excess pressure in the casing. Often additional protective devices may be desirable; these are listed in the table above.

Turbines under regulator control, but normally equipped with speed governors, usually operate with the speed governor at pre-emergency position. The regulator, however, provides normal control. The speed governor is free to assume control should a speed be called for which closely approaches the trip speed. The speed governor then becomes a protective device against overspeeding.

Mechanical Arrangement. Usually turbines or gears are flexibly coupled to the driven equipments. In some high-speed applications (or in the interest of a decrease in length) solid couplings or designs based on overhung rotating elements may be used. The latter arrangement however, must usually be custom built and may be quite expensive by comparison to the standard designs.

Belt or chain drives are used to some extent, particularly when turbines are used to replace engines and it is desirable to make no change in the driven-machine arrangement. In these cases, since turbine bearings are not usually designed specifically for increased loading from belt pull, it is often necessary to mount the sheave or sprocket on a jackshaft carried in its own pillow-block bearings and flexibly coupled to the turbine.

When dual pieces of equipment are to be driven or when it may be desirable to drive from the middle of a lineshaft and when speeds are within the range for economical gearing, it may be convenient to use the "double end" drive arrangement shown in Fig. 1. Multiple generator drives, Fig. 5, or combination mechanical-electrical drives, Fig. 6, may be used when several pieces of driven equipment are required to operate at fixed related speeds.

Turbines are usually built for only one direction of rotation. Except for marine propulsion units, expense of extra staging and casing arrangement for reversed rotation is seldom justified. Where the turbine is so economical that it will stand the increased cost and where reversed rotation is only for short duration, a motor with a disengaging clutch may be used to produce this operation.

To facilitate arranging equipment most gear manufacturers offer gears with the offset to either the right or left. Often this freedom of selection allows the purchaser to make the best use of his floor space for all equipment involved.

VERTICAL TURBINES

While the bulk of applications call for horizontal turbines there are some cases where vertical ones may be preferred. These are particularly applicable if conservation of floor space is important, as on shipboard. Fig. 7 shows a marine boiler feed pump and turbine for such service. But the variety of ratings, speeds and steam conditions as for horizontal units is not available or needed in the vertical designs.

ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*

7—Self-Induction and Mutual Induction

▶ BEFORE STUDYING electronic circuits, it will be worthwhile to learn about some of the effects we will encounter. So here, and in the next two articles, we will consider inductance, capacitance, reactors, capacitors, transformers and other devices used in these circuits. To simplify the studies, we will use the conventional, assumed direction of current flow from positive to negative.

Inductance. Self-inductance and mutual inductance are phenomena that occur in all electric circuits. When current flow either increases or decreases, a voltage is induced in the circuit that opposes the change. If current increases, it induces a voltage that opposes the increase. Similarly, when current decreases a voltage is produced that tends to keep current flowing. This action is known as self-inductance. Let's find out why this is so.

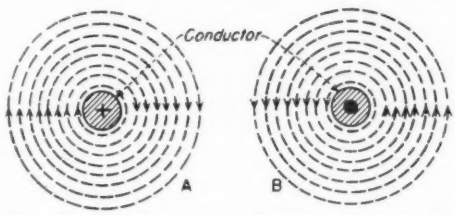
When a current flows in a conductor the former produces a magnetic field about the latter, which takes the form of concentric circles, shown dotted in Fig. 1. *A* and *B*. Direction of current flow determines direction of the magnetic field. The cross in the conductor's center indicates current flowing away from the reader. For this direction, the magnetic field revolves clockwise about the conductor, as arrows indicate, Fig. 1, *A*. Dot in the conductor's center, Fig. 1*B*, indicates current flow toward the reader, which produces a counter-clockwise magnetic field.

Induced Voltage. The magnetic field seems to emanate as circles from the conductor's center and increases in diameter as current increases, Fig. 2*A* to *D*. *A* represents the effect obtained with a small current, while *B*, *C* and *D* are successive developments of the magnetic field as current increases. When current decreases, the reverse effect occurs; that is, the magnetic field contracts to the center of the conductor as indicated by *D*, *C*, *B* and *A*.

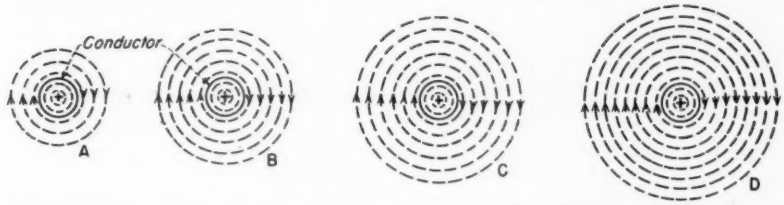
This increasing and decreasing of a magnetic field about a conductor as current increases and decreases induces (generates) a voltage in the conductor itself and in other closeby conducting material. This effect is produced just as a voltage is induced in the conductors of a generator's armature.

Fig. 3, which shows a magnet with a conductor in its field, illustrates the principle of an electric generator. A voltage is induced in the conductor if

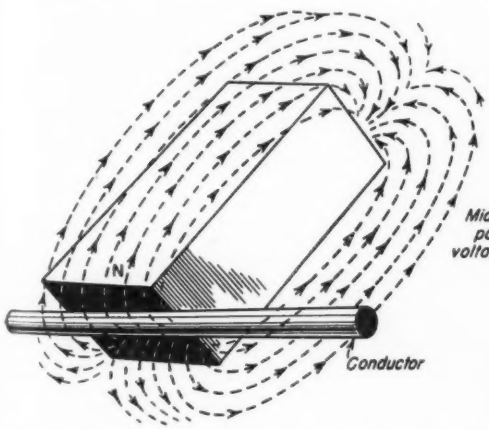
Magnetic Fields Around Conductor and Rules for Voltage Generation



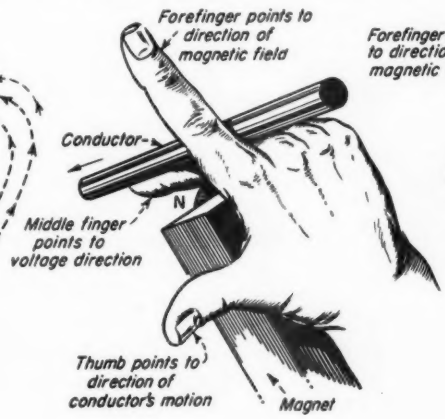
1 Current in conductor flows: A, away from the reader; B, flows toward him



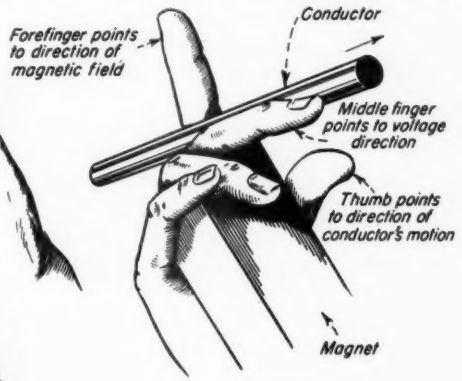
2 When current flows in conductor it produces a magnetic field emanating as circles from conductor's center; diameter increases as current increases, A to D



3 Magnet with conductor in its field shows electric-generator principle

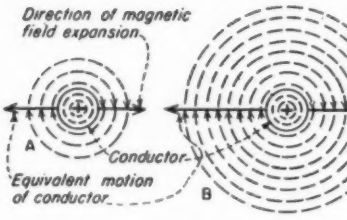


4 The right-hand method for determining voltage direction in a conductor

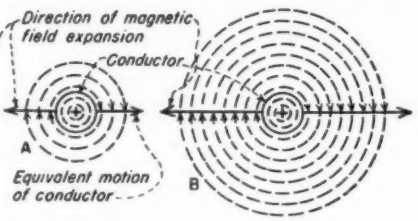

Forefinger points to direction of magnetic field
Conductor
Middle finger points to voltage direction
Thumb points to direction of conductor's motion
Magnet

5 When the motion of a conductor is reversed its voltage is also reversed

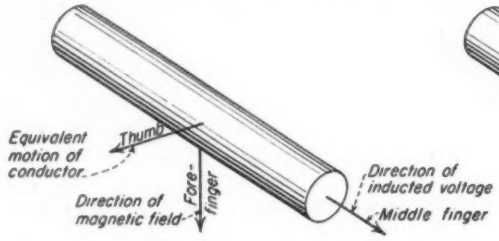
Voltage of Self-Induction



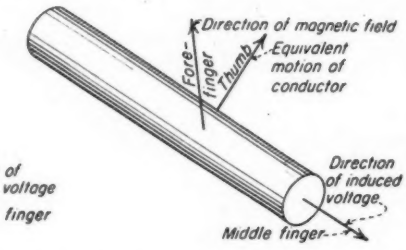
6 Conditions on right-hand side of the conductor when the current increases



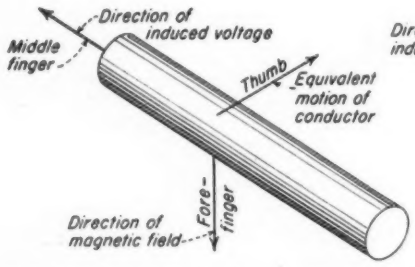
7 Conditions on left-hand side of the conductor when the current increases



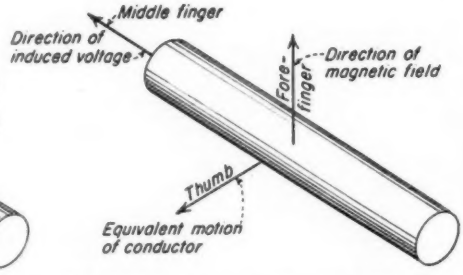
8 Induced-voltage direction on right-hand side of the conductor in Fig. 6



9 Induced-voltage direction on the left-hand side of the conductor in Fig. 6



10 Induced-voltage direction on right of conductor, Fig. 6, current decreases



11 Induced-voltage direction on left of conductor, Fig. 6, current decreases

it is moved up or down at right angles to the magnetic field. Connect the two ends of the conductor to another and a current flows in the circuit. It makes no difference whether the conductor or magnet moves as long as there is a relative movement of the conductor through the field not parallel to its lines.

Direction of voltage generated in a conductor cutting a magnetic field depends on the direction of the magnetic field and the conductor's motion. A number of rules determine voltage direction when direction of conductor motion and that of the magnetic field are known. Fig. 4 shows the simplest, and the one generally used.

To apply this rule, place thumb and first two fingers of the right hand at right angles, as in Fig. 4. Then, if the forefinger points to direction of the magnetic field and the thumb to conductor's direction, the middle finger points to direction of the generated voltage or current when circuit is closed.

In Fig. 4, induced-voltage direction is away from the reader. Reversing the conductor's motion reverses voltage direction, Fig. 5. The same effect would be obtained by changing the direction of the magnetic field, but not that of the conductor also. That is, put the conductor under a south pole instead of a north.

This is just what happens in an electric generator. When a conductor on a generator's armature moves across the field of a north pole it generates a voltage in a given direction. But when it moves across the field of the adjacent south pole, voltage direction is reversed.

Self-Inductance. Returning to Fig. 2, consider how the rule applies to self-inductance. The magnetic field about the conductor, which acts as if it originates at the conductor's center, expands outward as current increases, and contracts towards the center when current decreases.

Then, with an increasing current, on the right of the conductor the magnetic field would move to the right as arrows indicate, Fig. 6*A* and *B*. This is equivalent to moving the conductor to the left. Magnetic-field direction is down on the right-hand side of the conductor.

These motions are indicated in Fig. 8. Applying the right-hand rule to them for direction of induced voltage the middle finger points in the direction of the voltage arrow in the figure. Direction of the induced voltage is toward the reader, where direction of current flow is away, Fig. 6*A* and *B*. Therefore, induced voltage tends to prevent the current increasing in value.

If we test the left-hand side of the conductor, the magnetic field expands to the left with increasing current. This is equivalent to moving the conductor to the right; the magnetic field moves upward, as arrows indicate in Fig. 7*A* and *B*. Applying the right-hand rule to these conditions, the middle finger points in the voltage arrow direction, Fig. 9. This again is toward the reader or opposite to current-flow direction.

During decreasing current, the concentric magnetic field contracts toward the center of the conductor. Therefore, on the right-hand side of the conductor the field moves across it to the left. This is equivalent to moving the conductor to the right across the field, which has a downward direction. These directions are indicated by arrows, Fig. 10, and produce a voltage in a direction shown.

This voltage is away from the reader, or in the same direction as the current, and would tend to oppose a decrease in its value. Induced voltage in the left-hand side of the conductor is indicated in Fig. 11. From these checks we see how the expanding magnetic field with increasing current and the contracting field with decreasing current induce a voltage in the conductor by self-induction that opposes either an increase or decrease in current flow.

Mutual Inductance. Now consider two conductors, *L* and *E*, placed near each other with a current flowing in one of them, away from the reader, Fig. 12*A* to *D*. When the current increases, the magnetic field expands across dead conductor *E* to the right. This is equivalent to moving the conductor to the left across the field. These are the conditions we found on the right-hand side of the conductor, Fig. 6.

Therefore, Fig. 8 applies to direction of voltage induced in conductor *E*, which is toward the reader, as indicated by the dot in the conductor's center. With decreasing current, Fig. 12, the effects are the same as in Fig. 7 under the same conditions. So the direction of induced voltage, Fig. 10 and 11, applies to both.

We see that when a current increases

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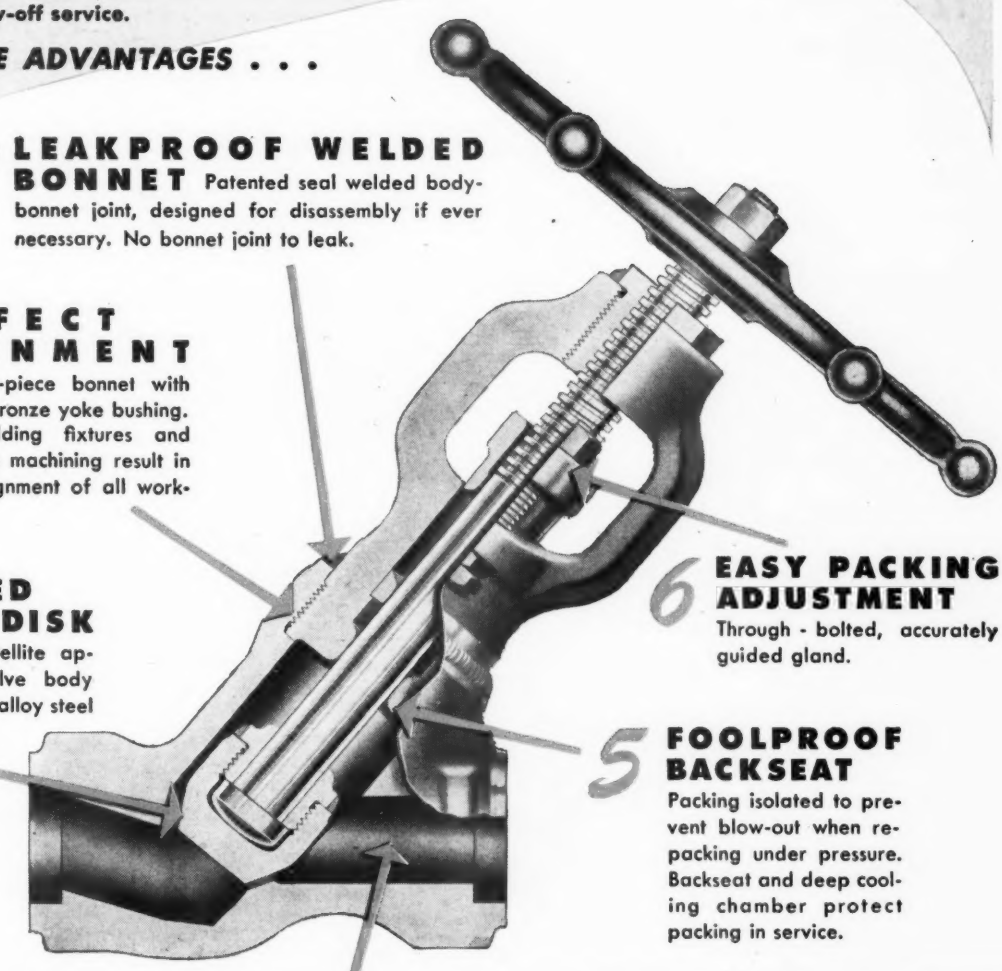

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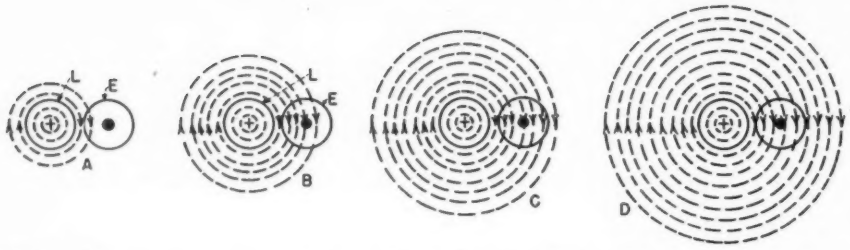
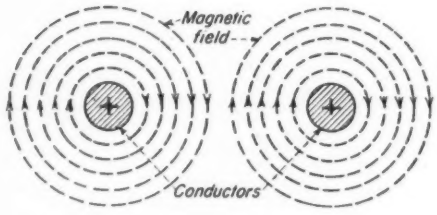
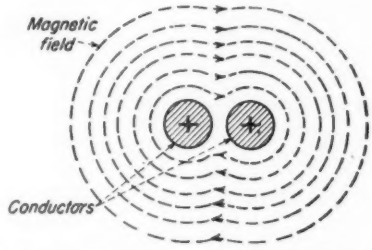
Voltage of Mutual Induction



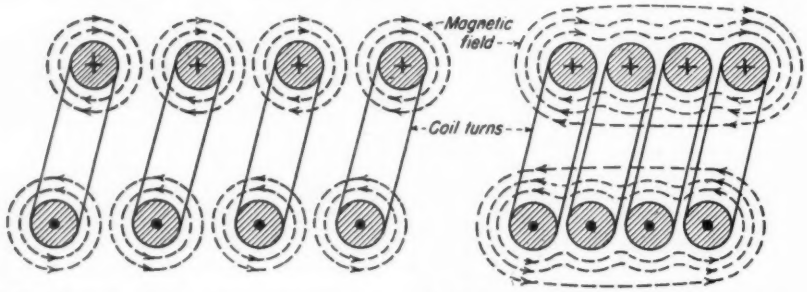
12 When current increases in a conductor its expanding magnetic field induces a voltage in adjacent conductor E, which is the principle of mutual induction



13 Magnetic fields around two conductors; current is in same direction

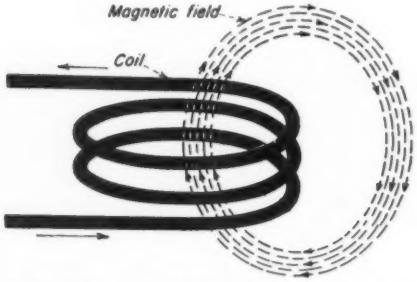


14 Brought together, magnetic fields around the 2 conductors, Fig. 13

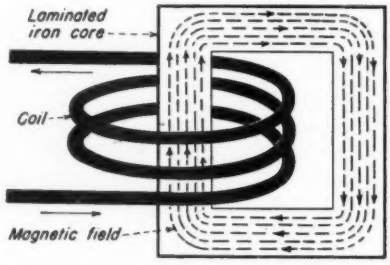


15 Magnetic fields around widely separated turns of coil carrying current

16 How magnetic fields around turns of coil combine to encircle all turns



17 Coils wound in the air have a low reactance except on high frequency



18 Reactors used in electronic circuits usually have a laminated iron core

in conductor *L*, Fig. 12, it induces a voltage in *E*, opposite to that applied to *L*. Also, when current decreases in *L* it induces a voltage in *E* in the same direction as the current flow in *L*. Voltage in *E* is produced by what is called mutual inductance. When mutual inductance induces a voltage in *E*, a voltage in the same direction is induced in *L* by self-inductance.

Voltages produced by inductance continue only as long as the current changes value. As soon as the current becomes constant as in a dc circuit the magnetic field ceases to expand or contract and no longer cuts across the conductor. In Fig. 12 the magnetic field moves downward by conductor *E*. But this is equivalent only to moving the conductor upward, parallel with the magnetic field. Therefore the conductor does not cut across the field, but simply moves in it and cannot generate a voltage. To do this, the conductor must have motion across the field, as when the current is increasing or decreasing.

Inductive Devices. Principles of self-inductance and mutual inductance are those involved in inductive reactors and transformers. These devices are used on ac circuits. Sometimes reactors are also used on dc circuits to limit inrush current temporarily to a device, or to smooth out current flow in a circuit.

Inductance or reactance in a straight piece of wire is small unless very long, as in a long line. To get increased reactance the wire is wound in a coil, either in air or on an iron core. Let us first study the open air coil.

Fig. 13 shows two parallel conductors in which an electric current flows away from the reader. They are assumed to be far enough apart so the magnetic field of one does not interfere with that of the other. Between the two conductors the magnetic-field direction is down for the left-hand one and up for the right-hand.

Bringing the two conductors together causes the magnetic fields between them to oppose each other. Since the two fields are of equal strength they neutralize each other, just as two equal opposing mechanical forces do, but this does not destroy the magnetic field. Fig. 14 shows what happens when we bring the two conductors together. The field about one conductor combines with that of the other and circles both instead of one, but in same direction.

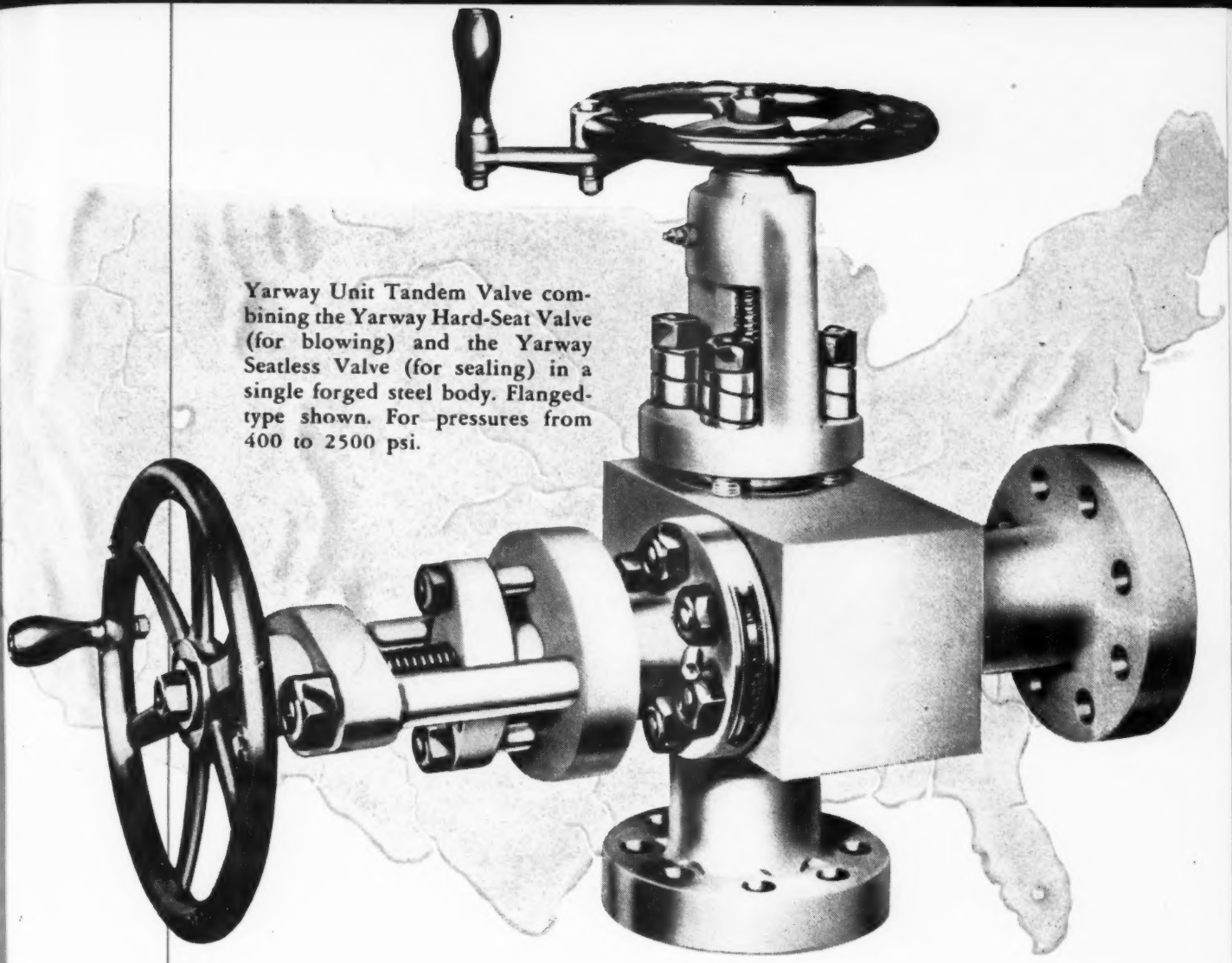
When a number of conductors are placed alongside each other with an electric current flowing in them, their magnetic fields combine to form one that encircles the group. This is the effect obtained in a coil of wire connected to an electric-power source.

Fig. 15 shows the cross section of a coil of four turns, the direction of the current being indicated by crosses and dots. The turns are assumed to be separated far enough so magnetic flux of one does not affect that of the other. Magnetic fields all move in the same direction on the outside as well as the inside of the conductors.

Consequently, if the turns are placed together as in Fig. 16 the magnetic fields about all conductors combine into one and surround the group as shown. That is, the magnetic field emanates from one end of the coil and enters the other, just as it does in a permanent or natural magnet.

In such a coil the magnetic field is increased many times over that for a straight wire of the same length as that in the coil. Consequently, the voltage induced in the conductor for a given change in current is many times greater in the coil than in the straight wire.

(*Continued on page* 136)



Yarway Unit Tandem Valve combining the Yarway Hard-Seat Valve (for blowing) and the Yarway Seatless Valve (for sealing) in a single forged steel body. Flanged-type shown. For pressures from 400 to 2500 psi.

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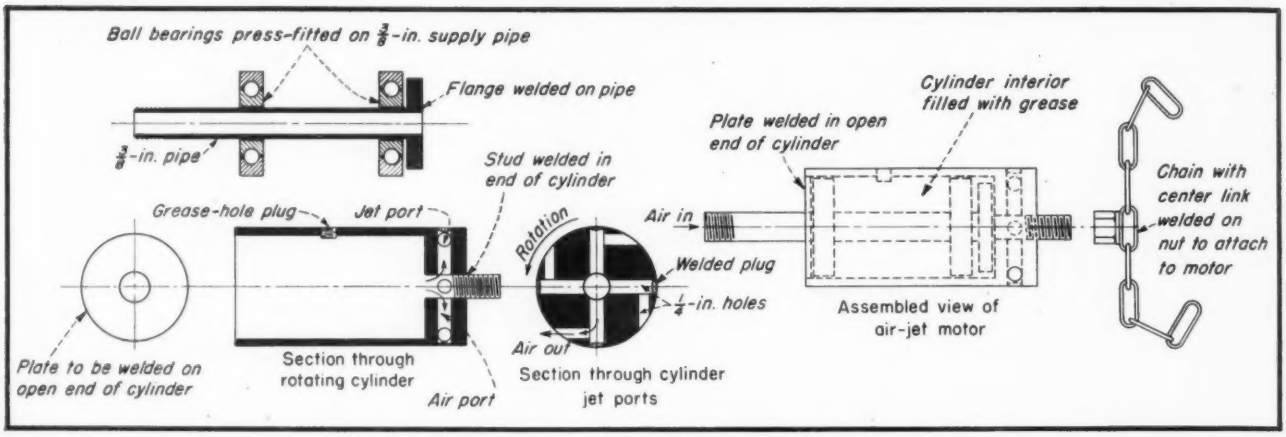
POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

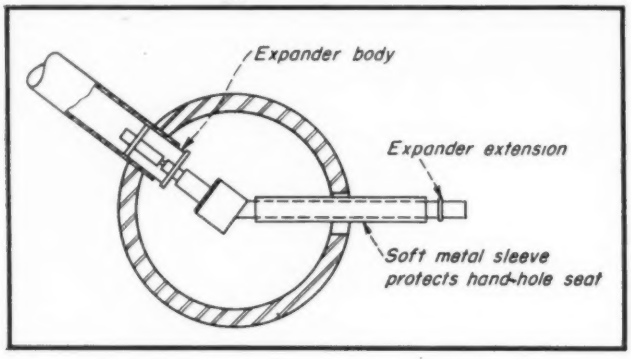

Ball bearings press-fitted on ⅜-in. supply pipe
Flange welded on pipe
⅜-in. pipe
Stud welded in end of cylinder
Grease-hole plug
Jet port
Rotation
Air in
Welded plug
¼-in. holes
Air out
Plate to be welded on open end of cylinder
Section through rotating cylinder
Air port
Section through cylinder jet ports
Plate welded in open end of cylinder
Cylinder interior filled with grease
Assembled view of air-jet motor
Chain with center link welded on nut to attach to motor

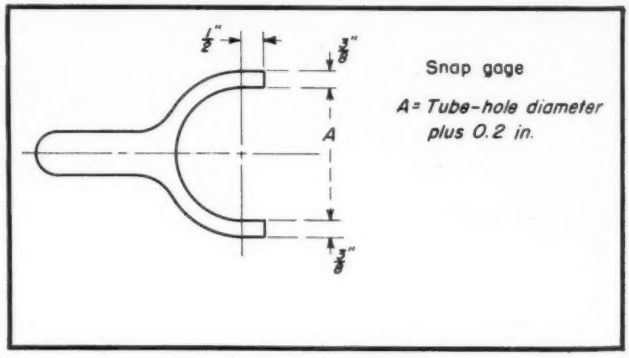
AIR-JET MOTOR CLEANS SCALE OFF BOILER-TUBE EXTERIORS

To GET better cleaning results on boilers using blast-furnace gas I designed the air-jet motor shown above. The motor turns at 12,000 rpm with 90-psig air pressure. Chain varying from 4 to 8 in. in length can be screwed on the motor stud. When pulled between boiler tubes the chain takes the shape of the tubes and does a good job of scraping scale off the tube surfaces. The high-speed air jets leaving the motor blow away the loosened scale.

Main parts of the motor are shown in section at the left, above. The cylinder in which the air ports are drilled, rotates and carries the stud to which the chain can be attached. Drills welded to suitable nuts can also be attached. The plate welded in the left end of the cylinder carries the thrust.

L B WHITLOW *Picayune, Miss.*





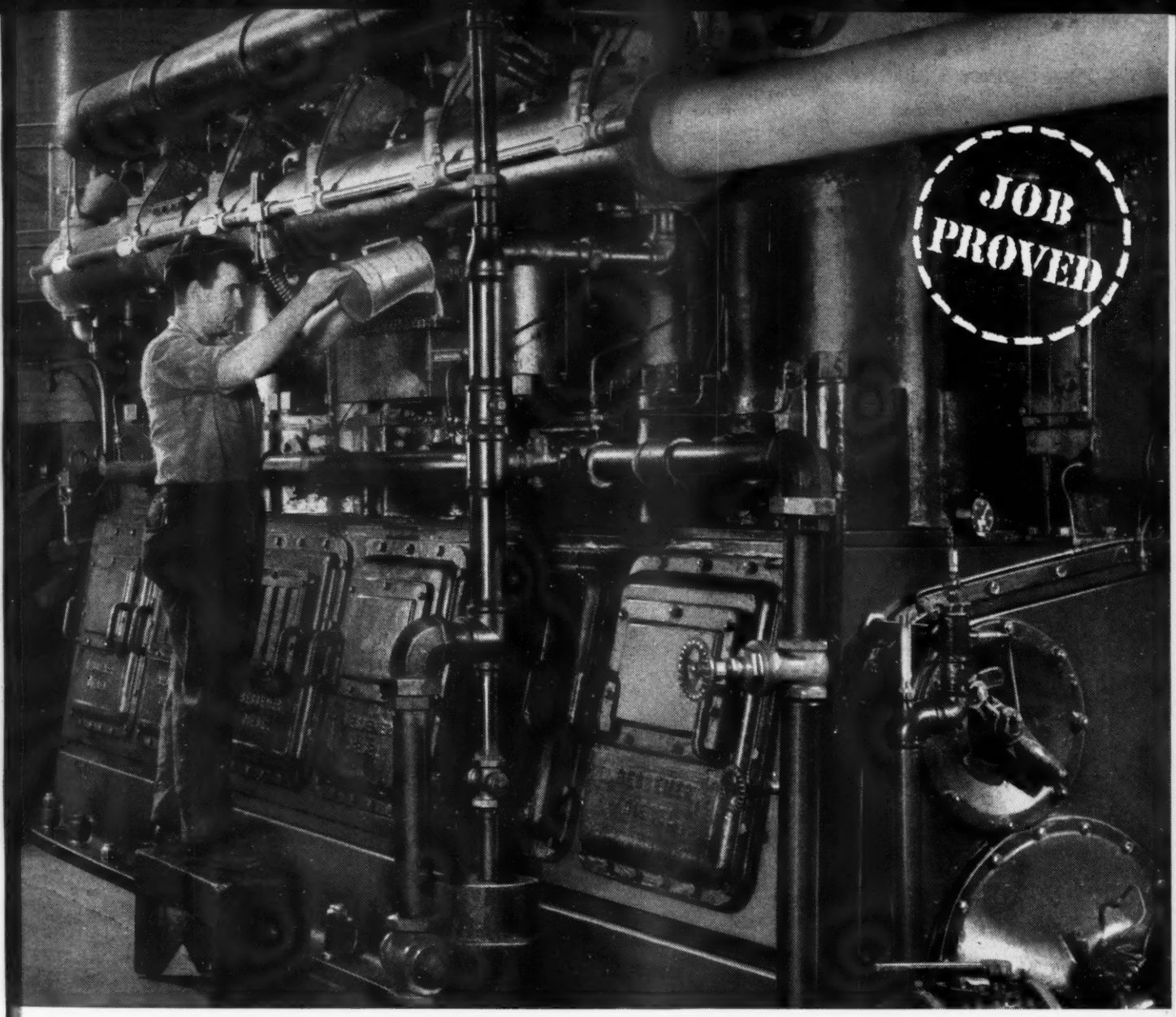
HERE'S A PROCEDURE FOR EXPANDING BOILER TUBES

LAST YEAR we had to replace twelve 3-in. tubes in the waterwalls of one of our boilers. Here's how we did the job. To prevent over-rolling the tubes we made a snap gage to the dimensions shown in the upper right sketch. While one worker expanded the tube, a second man checked the tube bulge frequently with the gage, and stopped the rolling at the proper time.

To protect the handhole seats of the lower drums we made several soft metal sleeves in our shop to fit over the extension of the expander as shown in the upper left sketch. Instructions were given to use vegetable oil instead of mineral oil and to keep tube projection between ½ and ¼ in. Two expanders were used, letting one cool while the other was in use. They were washed often in kerosene to keep them clean.

JOHN R BROWN *Bauta, Cuba*

(*Continued on page* 112)



4,200 HOURS' OPERATION—STILL SLUDGE-FREE

Sun Diesel Lubricating Oil Almost Good As New After Outlasting a Competitive Product 5 to 1

A prominent manufacturer uses 6-cylinder, 4-cycle diesels to generate power. Recently, at the suggestion of one of our engineers, a Sun diesel lubricating oil was tried in one of the units.

Results were impressive. Inspected after three months, the engine was found to be in the cleanest condition since installed. In tests run against competitive oils, one manufacturer's product sludged up in 600 hours. Yet the Sun oil was practically as good as new after 3,000 hours, showing but a slight increase in neutralization number. In further tests, the Sun oil ran 4,200 hours in six months' operation without a change; the engine remained clean and sludge-free, and showed no signs of wear.

On the basis of this performance, the plant has extended the use of Sun oil to other diesel units.

Here is just one example of the records being set by Sun "Job Proved" lubricants in all their wide applications. You can rely on Sun products to keep diesels, turbines, steam engines and other power equipment operating smoothly and with minimum maintenance. To get complete information call the nearest Sun Office. For Technical Bulletin "Lubrication of Diesel Engines," write Department P-11.

SUN OIL COMPANY · *Philadelphia 3, Pa.*

In Canada: Sun Oil Company, Ltd.
Toronto and Montreal

SUN PETROLEUM PRODUCTS

"JOB PROVED" IN EVERY INDUSTRY

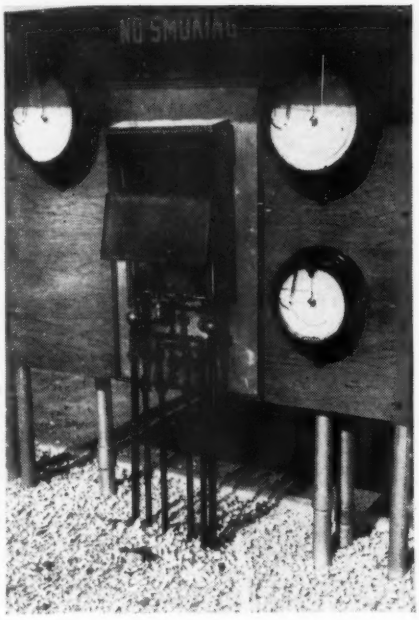
SUNOCO

 (*Continued from page* 110)

Sampling Box Simplifies Testing

To provide an accurate sample of any fluid passing through a line, at any time desired, a plant engineer rigged up the system shown in the photo, where a shunt flow from the pipe was made available.

A ⅜-in. loop was taken off the main line and reconnected to it again at a point downstream. A similar circuit was provided on a second main, and both brought to the sampling board. As long as either pair of valves stood open, there would be a flow corresponding to that within the big line. By closing the outlet valve and opening one into the thermometer and hydrometer well, it could be filled with fresh fluid. A drain valve allowed draining the well, when necessary, both for flushing and returning the sample to the plant sump. From here the fluid would be reinjected into the main line. A gooseneck connection, on a tie line between circulating loops and sampling wells, has a valve through which fluid samples may be drawn off for centrifuging or other testing.



As shown in the photo, the two sampling wells are enclosed in a metal box fitted with a hinged top and hinged front board. These safeguards are provided so the instrument may be protected from dirt and weather when not in use.

Elton Sterrett *Houston, Texas*

Oiling Condensers Prevent Corrosion

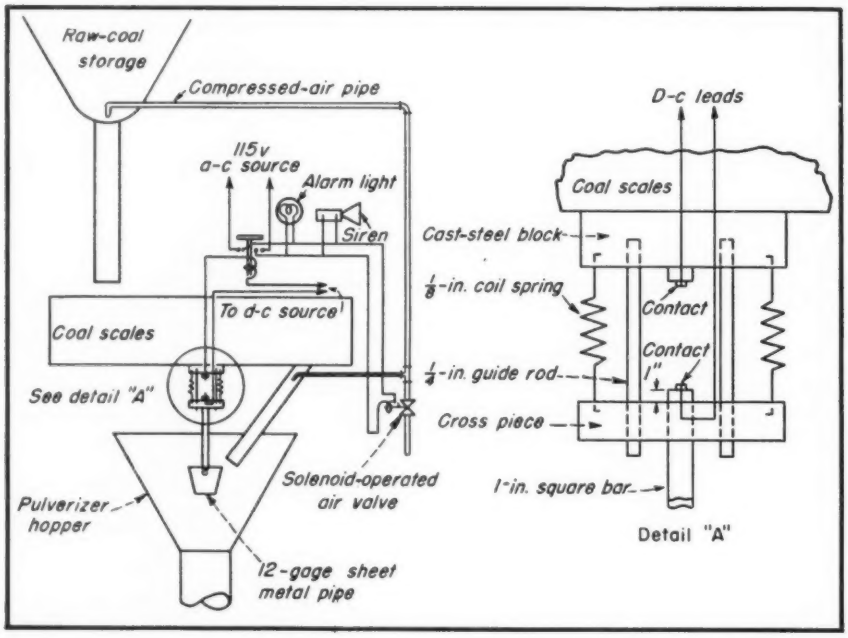
Condensers of air-conditioning systems are out of service four to five months every year. During this period they are subject to corrosion, which becomes serious because of subsequent decrease in operating life. Paint cannot be used on coils for protection because of reduced heat transfer. The inside walls of condensers, fans and fan housings should be thoroughly cleaned and painted for best protection.

Experience proves that spraying steel coils, spray heads and receivers with oil has done much to prolong the life of this equipment. Refuse lubricating oil can be used if chemically free, or any inexpensive grade of oil will do. To apply the oil, break the suction line on the pump and immerse in a bucket of oil. Run the pump as it will transport and spray the oil on the desired areas. Instead of this method a spray gun can be used with equal effect.

We have found the spraying of oil on fans that are badly corroded will help to clean and preserve them indefinitely.

H L Jones *Oklahoma City, Okla.*

ELECTROPNEUMATIC SYSTEM CLEARS COAL JAMMING



Frequent jamming of raw coal feed to the pulverizers in a plant caused many shutdowns. To free the packed coal and warn the operator the system as diagrammed at the left was built.

The detail shows the arrangement of contact points to control the energizing of the dc solenoid. The contact points in turn are controlled by the sheet-metal pipe hanging below in the pulverizer hopper. Inflowing coal strikes this pipe forcing it down and keeping the contact points open. Stoppage of coal flow allows the contacts to close and sound the alarm siren and light the warning bulb. In addition the ac circuit opens the solenoid-operated air valve in the 20-psig compressed-air line, supplying a steady air blast to the two points where jamming occurs most often.

This usually reestablishes coal flow and automatically shuts off the alarm circuit and air flow. Time lapse, about five minutes, between initial coal jamming and emptying of the pulverizer coal hopper proves an advantage. If the air blasts do not free the coal within a minute after the warning signal the operator has sufficient time to start another pulverizer. This had to be done, however, only once in three years of operation during which the alarm system has been in use. Points of jet application should be carefully planned.

Tyler G Hicks *New York, N. Y.*

Payday...

for a BOILER PLANT!

Every day is payday for a boiler plant when profits are poured back into it because of inefficient water conditioning. These profits "pay for" excessive blowdown, scaling, corrosion and foaming.

Correct water conditioning is a matter of careful and scientific control.

W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical.

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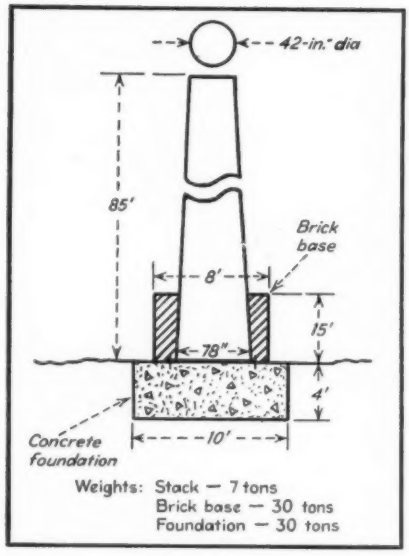
BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

PROBLEMS FROM THE PLANT

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

WHAT IS BEST WAY TO MOVE AN 85-FT SMOKE STACK?



▶ A POWER ENGINEER runs into all kinds of jobs that are off the beaten path. For instance, something we never met up with before is moving a smoke stack a distance of six feet. Here are the details:

We plan to install a new boiler, and to do so we have to move an 85-ft steel smoke stack laterally a distance of six feet. As shown in the sketch to the left, the stack has a base diameter of 78 in., and weighs approximately 7 tons. An octagonal brick base, which has an 8-ft diagonal, surrounds the lower part of the stack. We estimate that the weight of this base is 30 tons.

The stack and base are supported on a 10x10x4-ft concrete foundation that weighs approximately 30 tons. The foundation surface is level with the surrounding ground. We are hoping to move the stack, base and foundation as a complete unit.

In thinking over various ways to handle the job, we believe that our first step should be to set up guy lines from a ring near the top of the stack to nearby buildings. We then plan to fasten another set of guy lines from about midway on the stack to adjoining buildings. We think next best step is to undermine foundation ends and place H beams under each end. From beam ends we plan on chain slings to another parallel set of H beams, placed on rollers above. We may have to build a supporting concrete base on either side of the foundation for the roller ends. From shackles on the top H beam's ends, a system of pulleys could be rigged, and stack, base and foundation moved as a complete unit. It will be necessary to relocate the rollers placed under the H beam as the unit is moved.

All this sounds good, but since we have never handled such a moving job we are not sure about possible complications.

Perhaps some of POWER's readers have met a similar problem and will be able to help us outline a good procedure for handling the job.—*WA*

Readers' Answers

Which Heat Saver System Is Most Economical?

(This question is from August issue with best answers from readers.)

We evaporate an average of 750,000 lb of water daily from six boilers having 2690 sq ft of heating surface and operating at 135 psig with a 3% blowdown. Sketch [see POWER, August, p 112] *shows a continuous blowdown heat-saver system that has been proposed for installation in our plant.*

Our deaerating heater operates at 2 to 4 psi. Using an average of 3 psi, we could expect to flash about 15%, or 3375 lb of steam per day. This leaves 19,125 lb of blowdown per day for the second flash tank, which would probably flash about 1% from 3 psi to atmospheric pressure.

If the second flash tank and steam to the liquid heat exchanger were eliminated, heat in the 1% (or 191 lb) of steam would not be lost since it would pass through the liquid-to-liquid heat exchanger instead.

Will the slight increase in efficiency of the proposed system warrant the extra cost? I believe one flash tank and a liquid-to-liquid heat exchanger is the most economical system for us to install. Do POWER *readers think that I am right?*—CH

Use One Flash Tank and Larger Heat Exchanger

HEAT-SAVER SYSTEM, consisting of one flash tank and a liquid-to-liquid heat exchanger, is most economical for *CH's* plant.

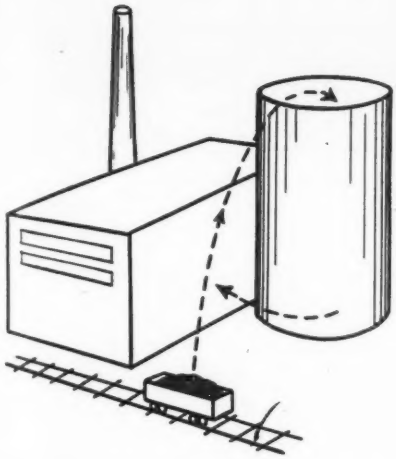
There will be no saving in adding the additional equipment shown in the original sketch. This is readily seen since all condensate leaving flash tank No. 1 will be discharged to the sewer in either case.

Quantity of heat that is lost to the sewer is essentially constant as the terminal temperature difference of the liquid-to-liquid exchanger is little affected by the slight increase in flow through it, caused by leaving out an additional flash tank and exchanger.

Heat available for heating makeup water will, therefore, be constant and can be absorbed in the liquid-to-liquid exchanger by increasing its heating surface by about 5%. This is obviously less expensive than adding apparatus and piping.

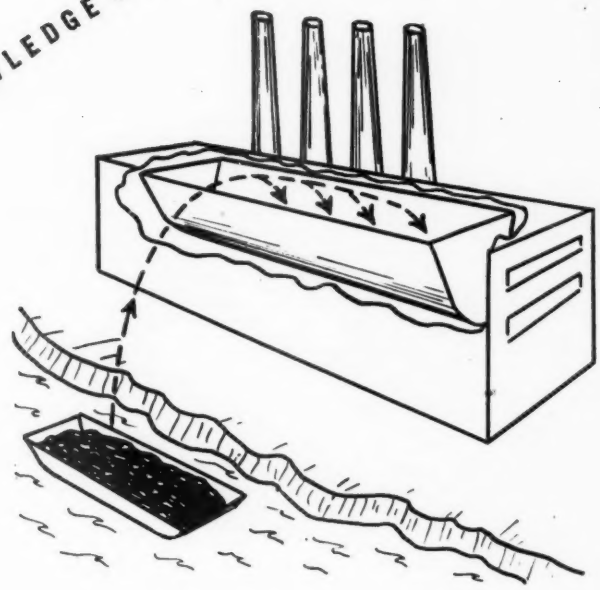
MILTON N KRAUS *Long Island, N. Y.*

(*Continued on page* 116)



Transporting coal without dust from car to storage silo, reclaiming from bottom for delivery to boiler room stokers.

BULK MATERIALS HANDLING TAKES KNOWLEDGE • EXPERIENCE • FACILITIES



Elevating coal from river barge and distributing it evenly in bunker.

The Problem's Half Solved When You Find Somebody Who UNDERSTANDS

When you talk with a Stephens-Adamson engineer, you'll find he is *qualified.* He *understands.* He has worked out hundreds of material handling problems for others. He has at his disposal the "case histories" as well as the men who did the planning on many more S-A engineered jobs.

Of equal importance, our engineers are not restricted to one or two types of equipment. The S-A Line includes a complete range of belt conveyors, bucket elevators, Redlers, skip hoists and other equipment. Your troubles can be overcome by the *one best combination.*

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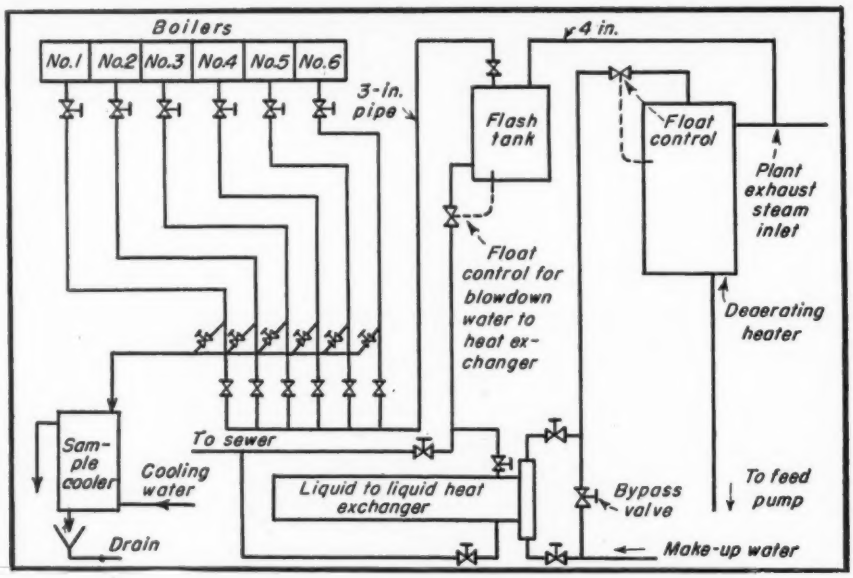


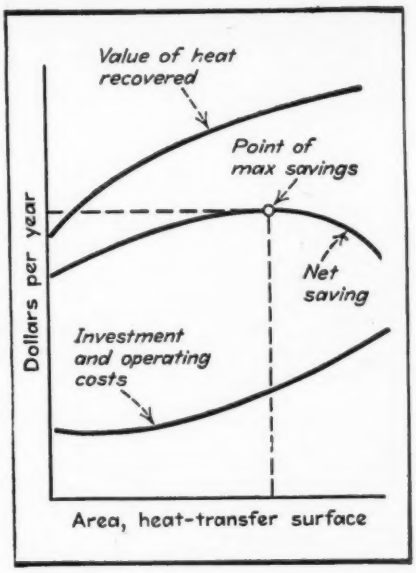
One Flash Tank Is Recommended for System

SINCE BOILER PRESSURE in *CH's* plant is only 135 psig, he is right in saying one flash tank and one heat exchanger is the most economical heat-saver system for his plant. The system proposed for him was undoubtedly designed for a high-pressure plant.

Sketch above shows a system that I believe will suit his needs best. Piping used should be larger than for a high-pressure system, in order to get all flash steam possible from blowdown water. About 50% of heat in blowdown water will be extracted from flashed steam while most of remaining heat will be given up to feedwater makeup through heat exchanger.

Flashed steam may be piped to heater steam inlet, as shown, or it may be used for process or plant heating if present exhaust steam fills demand for heating feedwater. Leave exact piping sizes to the design engineer.

ARTHUR BELTON *Montreal, Canada*



Outlines Economic Study

BEFORE *CH* can state positively that cost of extra flash tank is unwarranted, he must analyze the problem thus: Determine enthalpy of water leaving steam-to-liquid heat exchanger using ordinary heat-balance methods and calculate efficiency of both exchangers. Then find enthalpy of water leaving liquid-to-liquid heat exchanger when flash tank No. 2 is omitted. Difference between these two values gives amount of heat that must be added elsewhere in cycle. Multiplying this result by monetary value of one Btu in feedwater and number of operating days a year yields the extra annual cost of the single-flash-tank system.

Extra annual cost is then compared with annual cost of second flash tank, taking into account amount of money, depreciation, maintenance. This comparison quickly shows the most desirable economic system.

Addition of second flash tank and exchanger increases heat-transfer surface and efficiency of blowdown system. *CH* will find extent and efficiency of heat-transfer surface dependent on various factors, some of which are: (1) over-all coefficient of heat transmission (2) cost of a Btu (3) length of time the surface is used during a year. Analyzing the blowdown system completely and plotting the results, he obtains a curve like the above. This shows greater saving as heat-transfer surface increases up to a certain point. Increasing surface beyond this point decreases saving. Above method can determine system closest to maximum saving.

TYLER G HICKS *New York, N. Y.*

One Tank and Liquid-to-Liquid Heat Exchanger

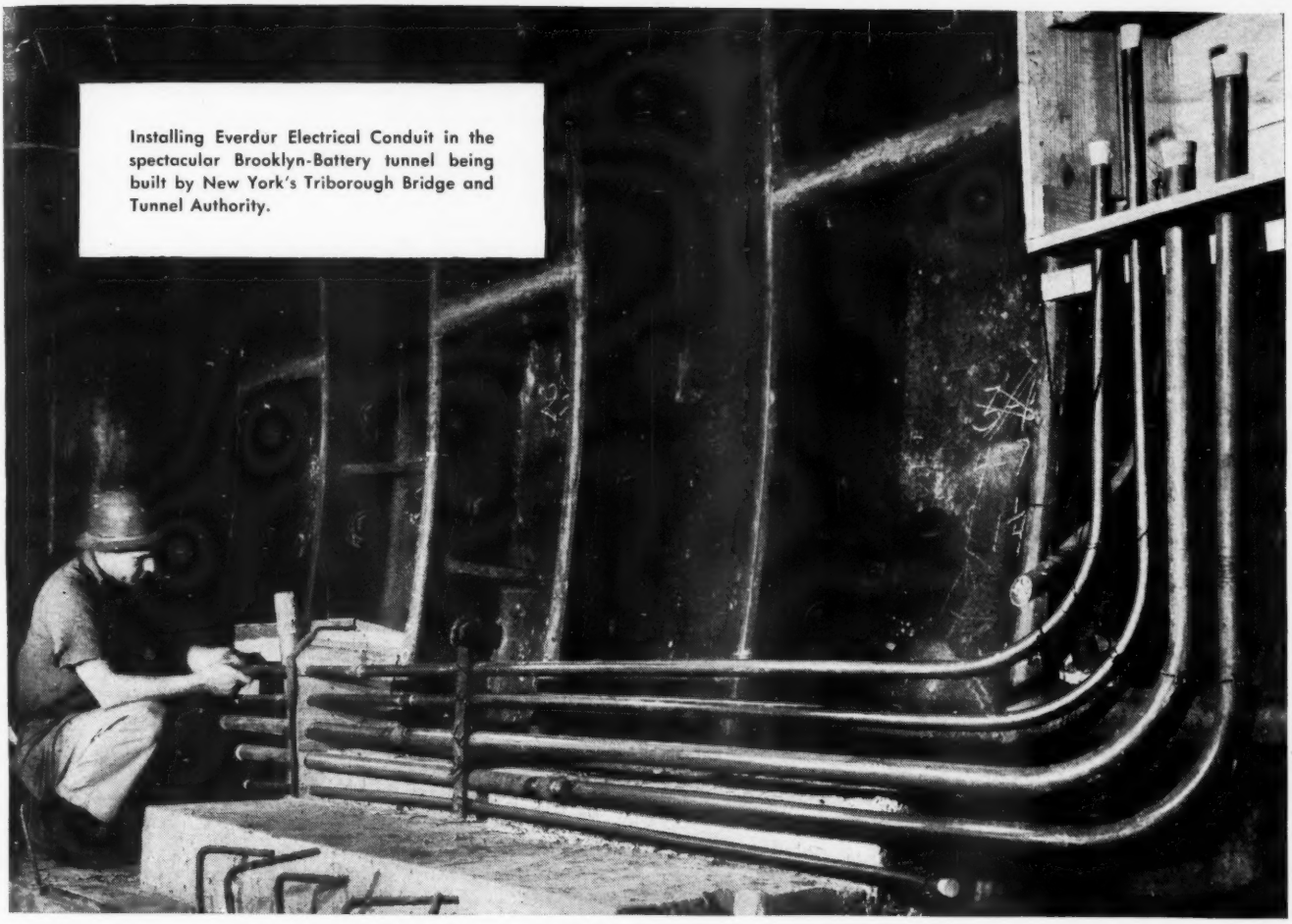
USE OF one flash tank and a liquid-to-liquid heat exchanger is most economical in *CH's* case. As makeup and blowdown are approximately the same, feedwater will be heated to 202.4 F provided blowdown is cooled to a temperature of 222.4 F.

Less heat-transfer surface will be required to heat feedwater to 202.4 F if blowdown inlet is at 3 psig rather than atmospheric pressure. Incidentally, liquid-to-liquid heat transfer requires less area than steam-to-liquid, and volume handled is far less than if the blowdown is not allowed to flash. Actually, if sufficient heat-exchanger area is provided in either case, fuel saving will be the same.

If flash tank No. 2 is eliminated, care must be taken to prevent blowdown liquid at 3 psig from flashing at entry to heat exchanger. It will not if friction loss through exchanger is over 3 psi. Pressure can be maintained in exchanger by throttling or by installing a short riser in outlet. Outlet pressure can be less than 3 psi as blowdown has been cooled at this point.

Assuming a boiler efficiency of 75% and coal at 14,000 Btu per lb, actual savings are easily worked out. Flashed steam to the deaerator saves 61 tons of coal per year. Cooling blowdown from flash tank No. 1 to 80 F (whether flash tank No. 2 is used or not) saves 49 tons of coal per year. As a matter of interest, latent heat in steam flashed from No. 2 tank amounts to only 3.6 tons of coal per year.

W L GOVAN *Ontario, Canada*



Installing Everdur Electrical Conduit in the spectacular Brooklyn-Battery tunnel being built by New York's Triborough Bridge and Tunnel Authority.

EVERDUR CONDUIT

protects wiring in nation's biggest under-water tunnel

IN NEW YORK'S new 77 million dollar Brooklyn-Battery vehicular tunnel, one and three-quarter miles of Everdur* Conduit will carry traffic light and control cables, telephone and other communication lines. Both RC and EMT are being used in sizes from ¾" to 4".

Control boxes will be located every 250 feet along this 9,117 foot four-lane sub-marine boulevard. These boxes are likewise being fabricated from Everdur Copper-Silicon Alloys.

No stranger to long-term service under extremely corrosive conditions, Everdur Conduit has performed impressively on the Delaware River Bridge since 1935, and in Pennsylvania Turnpike tunnels since 1940. Its long life in refineries, sewage plants and chemical works are good reasons for its use under New York Harbor.

Everdur Conduit possesses high strength, is non-magnetic, workable and weldable. It is available in two wall thicknesses: rigid conduit (RC) in nominal sizes from ¼" to 4" inclusive; and the thinner walled electrical metallic tubing (EMT) in nominal sizes ⅜" to 2" inclusive. Complete lines of fittings . . . connectors, couplings, outlet boxes, etc. . . . are available in Everdur Alloys from leading manufacturers.

48223

*Reg. U. S. Pat. Off.

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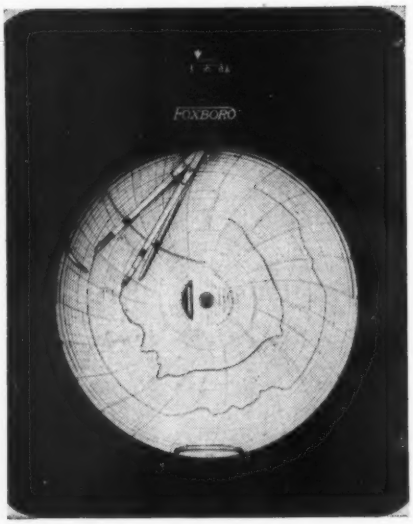
NEW PLANT EQUIPMENT



Automatic Controller E408

AUTO-SELECTOR CONTROLLER controls selectively from either of two related variables, by positioning a single valve, damper or other operator. Selection is determined by the variable having the greatest tendency to exceed its preset limit, and the transfer of control is made smoothly, instantly and automatically. Instrument not only does the work that previously required two controllers, but has the advantage that it may incorporate the automatic reset function in control of either or both variables. Design embodies two measuring systems and two interconnected Foxboro Model 40 mechanisms. Control action of both mechanisms may be on-off, proportional, proportional with derivative, proportional with reset, proportional with reset and derivative, or any combination of these. Controller is available as a recorder or indicator. **Foxboro Co, Foxboro, Mass.**

Air Compressor E409

PAC-AIR is a portable self-contained, completely air-cooled gasoline engine-driven air compressor. The 2-cylinder single-stage compressor has a piston displacement of 37.5 cfm at 80 psi. Unit is equipped with an automatic unloader that permits the compressor to operate at constant speed, but compresses air only when needed. Compressor and engine are mounted on an air receiver that forms an integral part of running gear. Pneumatic tires and a quick detachable ball-and-socket type trailer hitch make the *Pac-Air* easy to tow behind truck or passenger car. **Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y.**

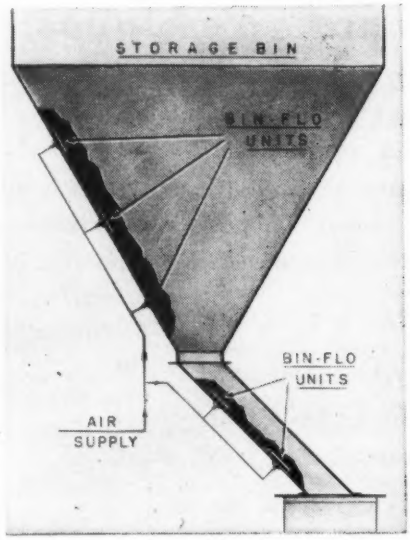
Adjustable Port Valves E415

THESE ADJUSTABLE PORT VALVES give good performance with throttling-type control motors because they give about equal changes of flow for equal angular movement of the valve arm. Clockwise turning of port-adjusting screw decreases resistance to flow by uncovering a greater portion of the available port. Angular movement of control handle then successively increases or decreases size of the port, in accordance with demands of control instrument. Multiple valves can be driven either through linkage or gear trains. **North American Mfg Co, Cleveland 5, Ohio.**

Dry Lubricant E447

WITH LIGHT RUBBING this lubricant adheres to even the smoothest surfaces, has an extremely low friction coefficient and a large capacity to prevent galling, seizing, or metal-to-metal contact at bearing pressures well over 100,000 psi. *Molykote* consists essentially of molybdenum disulphide powder and has the appearance of graphite, though it contains none.

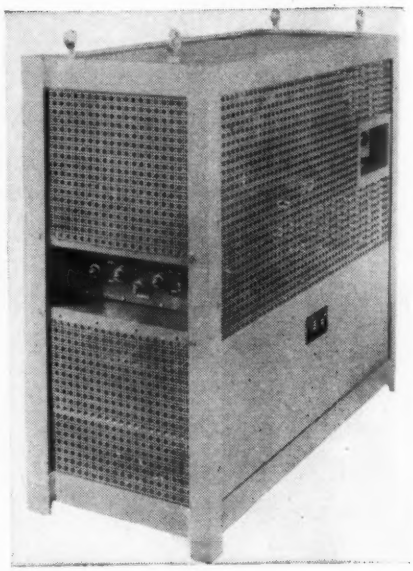
Molykote may be mixed to a paste with SAE 10 motor oil. It is equally suitable for high-, low-, and room-temperatures; 10 oz will cover 500 sq ft of smooth metal surface. **Alpha Corp., Greenwich, Conn.**



Material Handling E426

A SMALL METAL PLATE, $3\frac{3}{4}$ by $7\frac{1}{2}$ by $\frac{1}{2}$ in. thick, in conjunction with a compressed air system, located at points of restricted flow in bins, hoppers and chutes, is said by its manufacturer to give uniform feed of bulk materials.

Low-pressure air supplied through a piping system is injected into the material under movement through a fabric diffuser. Results are said to be good where material is dry. **Dept J-916, Bin-DicTator Co, 14615 E Jefferson Ave, Detroit 15, Mich.**



Voltage Regulator E456

NEW TYPE 5- and 10-kva regulators are available in either 115- or 230-v models. Incoming-line voltage may vary between 95 and 125 v, or 190 and 250 v ac, without affecting regulation accuracy of 0.5%. Harmonic distortion produced by these units never exceeds 5% in standard models and 3% in *S* models. Frequency changes between 50 and 60 cycles will not affect output voltage or performance. **Sorensen & Co, 375 Fairfield Ave, Stamford, Conn.**

Sealing Compound E430

HEAT-INSULATING SEALING COMPOUNDS withstand temperatures as high as 2800F. *Stabond FR*8 and *FR*10 are available in different consistencies for application by trowel, brush or extrusion gun. **American Latex Products Corp, 921 Venice Blvd, Los Angeles 15, Calif.**

Welding Rods E431

RECLAMATION and hardfacing applications can be met with either *Tube Tungsite* or *Tungrod*. *Tungsite* consists of tungsten carbide particles, ranging from 5- to 40-screen size enclosed in a steel tube. When applied as a welding rod, steel tube melts easily, evenly distributes hard tungsten carbide particles and gives a weld deposit that

Use convenient reply cards on page 178a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

Simple pipe bend . . .
Or complex unit fabrication
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No job is too difficult for Crane Pipe Fabricating Shops. Strategically located . . . skillfully manned . . . Crane Shops give you the finest fabricated piping service available. For Crane completes your *entire* job—bending, stress relieving, heat treating, even radiographic examination of welds, if required—before testing each assembly as a unit.

Whether for power or processing systems, high or low pressures—Crane unit fabrication of valves, headers and other piping assemblies stands out as the finest combination of materials and workmanship. All operations are rigidly checked under laboratory supervision. Strictest adherence to specifications helps to fulfill every intent of your design. And since Crane Shops prove major assemblies in advance of installation, your piping systems are completed in the field with least effort and delay.

Crane Co., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill. *Branches and Wholesalers Serving All Industrial Areas.*

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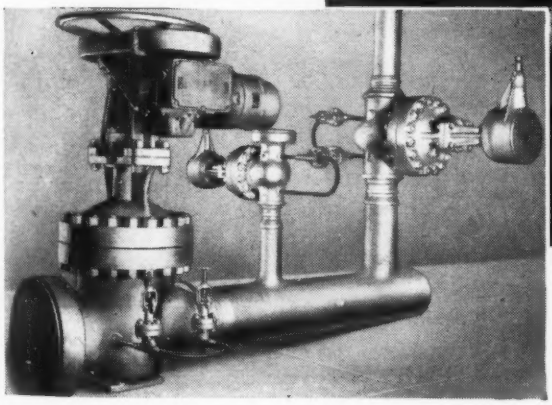
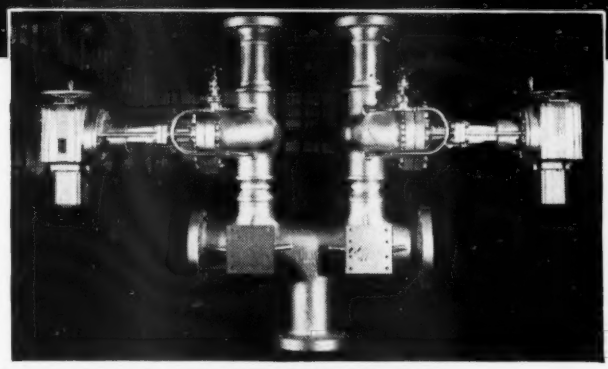
RESPONSIBILITY
STANDARD OF QUALITY

FOR BOILER FEEDWATER *service in Arkansas power station, this integrated header contains 17 welding-end valves. Fabricated by Crane and delivered as a unit.*

12 x 8 x 4-IN. HEADER ASSEMBLY *shipped as a unit to a central station. Completely fabricated, stress relieved, and tested by Crane.*





STEEL HEADER *with two Crane 8-in. motor-operated gate valves. Fabricated as a unit in Crane Chicago shop for main steam service at 850 psi and 900 deg. F.*

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VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

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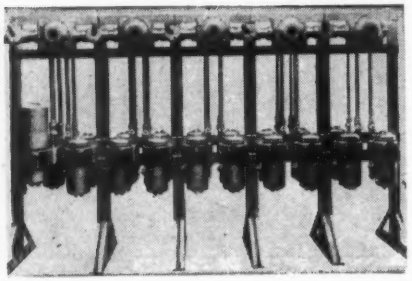
SEE YOU at the POWER SHOW - - BOOTH 53

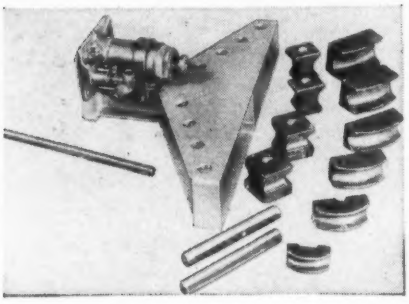
FOR EVERY PIPING SYSTEM

makes a hard wearing surface. *Tungrod* employs tungsten carbide particles from 40 screening down. **Dept 647, American Brake Shoe Co, 230 Park Ave, New York 17, N. Y.**



Control Equipment E448

THIS ASSEMBLED explosionproof control equipment is suitable for refineries, utilities and other industries where safe, dustproof and waterproof conditions are of primary importance. Assembly includes junction boxes, sealing fittings, and combination starters, all in explosionproof, weatherproof, watertight and dustproof housings. Typical installation is the assembly of five motor-control groups, each providing complete control for four motors. Above illustration shows plan and end view on an 8-motor unit control group. **Electro Mechanical Devices Co, 49 Selden, Detroit 1, Mich.**



Pipe Bender E413

LIGHTWEIGHT PORTABLE TOOL can be used to bend pipe right on the job. Combined weight of the jack and frame is only 83 lb. The 30-in. steel frame is electrically welded and heavily reinforced. It comes complete with ¾, 1, 1¼, 2 and 2½-in. dies. Hydraulic jack is removable and can be used for other jacking jobs. **Electric Cord Co, 30 Church St, New York 7, N. Y.**

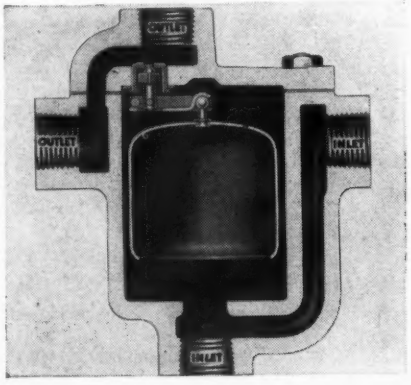
Centrifugal Pump E449

DESIGNED WITH SPLIT CASING for easy inspection and maintenance this pump is available in capacities of 650 gpm with 260-ft total discharge head or 300 gpm for 320 ft total discharge head. About 50-hp motor or steam turbine operating at 3450 rpm is needed with each pump.

Splitpacking gland permits easy repacking and gland replacement without dismantling pump. Discharge may be turned in eight different directions without relocating packing glands. Pump casing is available in most any castable alloy, such as stainless steel, monel *NiResist*, in addition to the usual iron, steel, bronze, aluminum and nickel. **Dean Hill Pump Co, 4000 East 16th St, Indianapolis 7, Ind.**

Rust Preventive E425

SMALL QUANTITY of RD-119 in petroleum products puts an invisible polymolecular protective layer on metal surfaces. It is so effective as a rust and corrosion-proof coating for storage tank, pipeline and diesel service, maker claims, that 2.5 gal in 42,000 gal of petroleum product gives protection. **Sinclair Refining Co, 630 Fifth Ave, New York, N. Y.**



Steam Trap E412

CLARK 60 STEAM TRAP is furnished with various-sized seat orifices for working pressures up to 150 psi and temperatures up to 375 F. This small inverted-bucket type trap embodies such features as a positive-seating guided disk, which is free-swinging and self-aligning, and operates with minimum friction. Disk always remains centered with seat opening. Inlet and outlet can be piped up either vertically or horizontally, making the trap adaptable to any pipe arrangement. **Clark Mfg. Co, Cleveland, Ohio.**

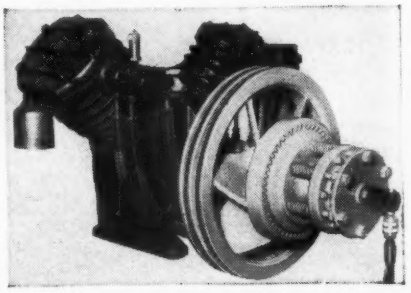
Multi-Purpose Grease E441

IN MANY PLANTS *X*-5 is used as a general lubricant, decreasing time between applications as well as serving a wide variety of uses. This grease does not combine with water and changes but little in temperatures up to 400 F. Economy results from the fact that this grease does not thin or drip from bearings. **Freedom-Valvoline Oil Co, Freedom, Pa.**

Wire Stripper E446

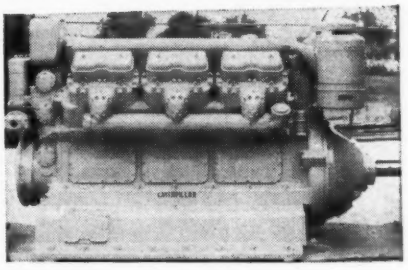
A SIMPLE TWIST AND PULL is all that is required to strip insulation from No. 12 to No. 22 solid or stranded wire with this *Quick-Strip* wire stripper. The tool has a round, hardened blade attached to a plastic handle available in various colors. Blade contains three slots to accommodate and strip various-sized wire; fourth slot cleans wire.

Tool removes not only rubber, fabric or plastic insulation, but cuts and removes braided wire shielding used on microphone cable. **Dept F7, Jaco Products Co, 6408 Euclid Ave, Cleveland, Ohio.**



Air-Compressor Clutch E460

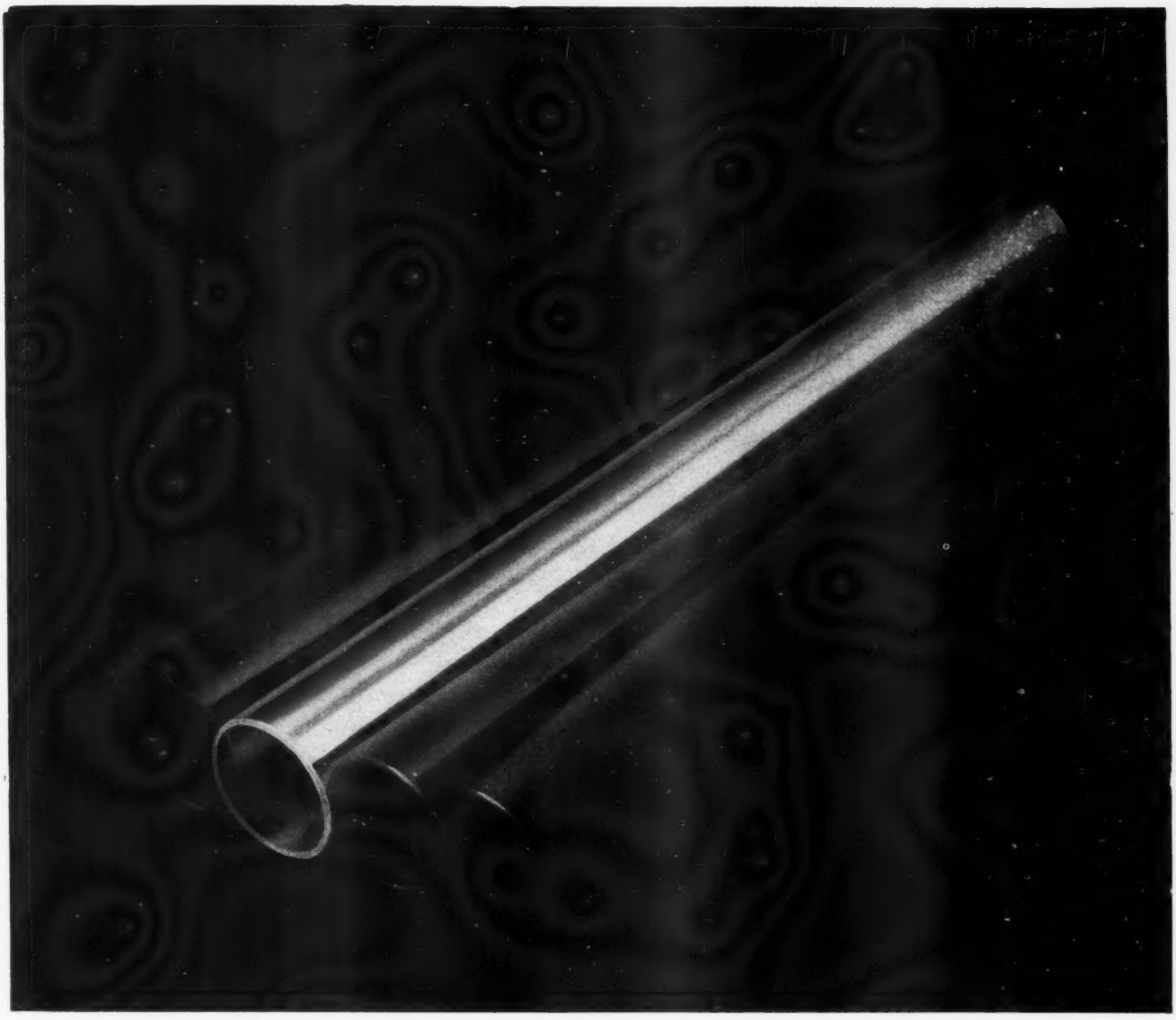
INTENDED FOR HEAVY-DUTY USE, this completely automatic clutch requires no attention from operator. Air pressure acts on a diaphragm to disengage the clutch, starting and stopping at any desired maximum or minimum pressure. Easily accessible at all times, the clutch may be mounted with the air compressor at outer end of power unit output shaft and driven by a V-belt pulley on output shaft. Friction lining wears up to a full ¼ in. before replacement is necessary. **Wichita Falls Foundry & Machine Co, Wichita Falls, Texas.**



Diesel Engines E473

FOUR LARGER ENGINES for industrial power, diesel-electric sets and marine application have been added to maker's line. Cylinder dimensions are 5¾ x 8 in. Units have full-load speed range of 800 to 1200 rpm and a 60-deg "V" arrangement of either 8 or 12 cylinders. Models are as follows: *D*397, a V12 engine with blower (illustrated), maximum output 500 hp, rated output 430 hp and continuous output 400 hp; *D*386, a V12 engine, maximum output 400 hp, rated output 360 hp and continuous

Use convenient reply cards on page 178a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.



REVERE detects *VIBRATION* at a distance

DO you know that vibration can be present in the tubes of a condenser, though not perceptible in the shell? Putting the palm of your hand on a condenser is not a good test for destructive vibration. The best test is one carried out in the Revere Research Laboratory in Rome, N. Y., which makes a microscopic examination of the metal as a part of its work in determining causes of tube failure. If vibration contributed to short life, this examination will show it. Vibration accelerates corrosion in several ways. The alternating stresses in time produce cracks across the grain of the metal, weakening it and giving corrosive fluids more points to attack. Vibration also breaks or disrupts or disturbs the thin film on the surface of the metal that protects it and helps reduce the rate of corrosive attack. Of course vibration is but one of a number of factors influencing the service life of condenser tubes, and so when tube life is questioned we always suggest that samples from failed tubes be sent to us. We may be able to help you, as we have others, with suggestions that should materially extend the period between re-tubings.

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COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

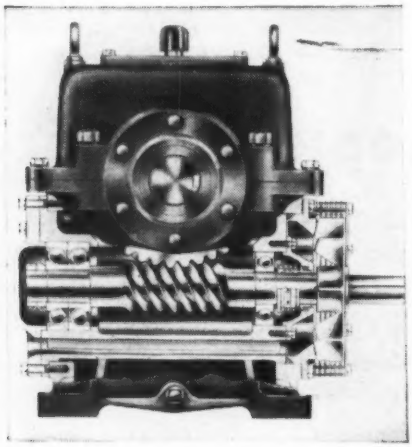
230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere

output 320 hp; *D*375, a V8 engine with blower, maximum output 334 hp, rated output 300 hp and continuous output 268 hp; *D*364, a V8, maximum output 267 hp. rated output 240 hp and continuous output 214 hp.

All four engines are designed for 100% power takeoff at either end. Parts are interchangeable between engines of like number of cylinders. Lubrication, fuel-injection, cooling and starting systems are similar in all four units, as are the governor flywheel housing, crankshaft and bearings, connecting rods, pistons and rings, cylinder liners and head, valves and cylinder block. Choice of electric or air starting is offered.

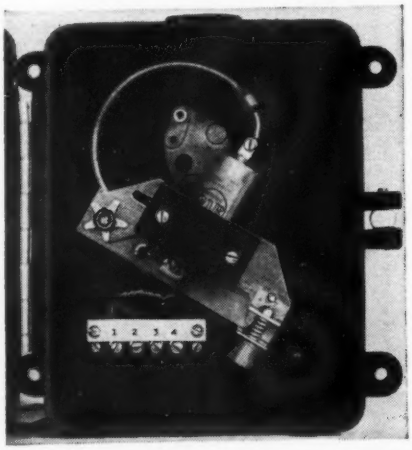
Crankshaft is drop-forged high-carbon steel with hardened journals. Drop-forged steel connecting rods have crankpin bearings of solid aluminum alloy and precision-bored bronze wristpin bushings. Main bearings are also precision type, of solid aluminum alloy. Trunk pistons are aluminum alloy with three compression and two oil rings. Full-floating carburized and hardened ground piston pins are provided. Removable wet-type hardened alloy-cast-iron cylinder liners are chemically treated for superior "break-in." Single inlet and exhaust valve for each cylinder are of in-head type. Engines are full pressure lubricated. A gear transfer pump supplies fuel through replaceable absorbent filters to individual fuel-injection pumps with the fuel delivered under pressure to the single-orifice fuel-injection valves. A hand-operated pump permits priming the fuel system before starting the engine. **Caterpillar Tractor Co, Peoria, Ill.**



Worm-Gear Drives E468

HYPOWER UNITS have high thermal capacity permitting smaller, less expensive reducers, saving on original cost. Leakage of oil is prevented by carbon lap ring type seal.

Drives are available in horizontal and vertical types, single and double worm-gear reduction, with a wide range of standard ratios to meet practically any need. Units comply with the speed-ratio standards adopted by the American Gear Manufacturers' Association and the National Electrical Manufacturers' Association. **Foote Bros Gear & Machine Corp. 400 W Madison St, Chicago 6, Ill.**



Pressure Indicator E420

HEART OF THE ATCOTRAN SYSTEM is based on applying a differential transformer, which develops a linear output, to standard primary measuring elements such as bourdon tubes or bellows. The indicator eliminates objectionable inherent characteristics of the bourdon tube because tube is not loaded with instrumentation gear. Only armature of the differential transformer is connected to tube tip. There are no jewel bearings, pivots, springs or similar movements. The tubes, which may be loaded to full rated range, consistently return to zero position within accuracy limitation of the Atcotran system. Instruments are accurate to within one-quarter of 1% reading; sensitivity is one part in 4000, or better.

Any number of pressure transmitters, of either the same or different ranges, may be read from one common indicator equipped with selector switch stations. Pressure pickup transmitters consisting of *K-Monel* bourdon tubes mounted in dust-tight enclosures are suitable for corrosive applications. Comes in six standard ranges from 0 to 10,000 psi. **Automatic Temperature Control Co, 5212 Pulaski Ave, Philadelphia 44, Pa.**

Welder E435

LIGHTWEIGHT, engine-driven, dc welder weighs 660 lb, has a maximum welding current of 250 amp. An air-cooled engine, speed-ratio-coupled by a steel core V-belt to a generator with a 50% duty cycle, powers the 44⅛ in. by 24½ in. by 35⅜ in. high welder. **General Electric Co, Schenectady 5, N. Y.**

Turbine-Type Pump E467

DESIGNED FOR industrial and domestic applications requiring pressures to 175 psi, speeds to 3600 rpm, capacities to 150 gpm, and viscosities to 550 ssu, this pump handles liquids under extreme temperature variations without stalling through use of an automatic, self-adjusting impeller. Very hot liquids can be pumped without vapor-binding.

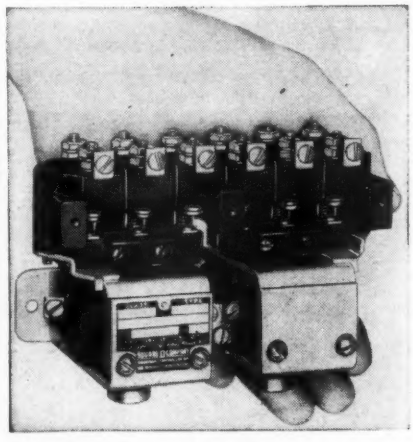
This turbine-type pump has a single multivaned impeller that develops high pressures in single-stage construction. Both heads and impeller, available in either bronze or stainless steel, are renewable in case of wear or whenever pump capacity is to be changed. **Roy E Roth Co, Rock Island, Ill.**

Drying Agent E429

RELATIVELY HARD, granular drying agent has high absorptive properties for oil, grease and water drippings. Industrial *Floor-Dry* is also said to give high coverage and increase light reflectivity because of its color when spread over the floor. **Industrial Floor-Dry Dept, Eagle-Picher Co, American Bldg, Cincinnati-1, Ohio.**

Welding Electrode E434

HIGH TENSILE-STRENGTH WELD results from use of *Airco* No. 394, a low-hydrogen coated electrode designed to prevent underbead cracking in weld deposits. Electrode operates on either ac or dc and is said to give good service with hardenable steels. **Air Reduction Sales Co, 60 East 42nd St, New York 17, N. Y.**



Reversing Contactor E439

DESIGNED TO CONTROL small ac and dc motors used in connection with hoists, overhead doors, monorail cranes, mechanical speed changers, and other intermittent duty applications, this new contactor is compact and well-insulated between all live parts

(*Continued on page* 134)

Use convenient reply cards on page 178a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

No matter how small your chemical needs . . . . .

Complete Nalco WATER TREATMENT SERVICE

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ONE or more of these conditions usually cut chemical needs for water treatment:

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- A complete plant water treatment survey; with detailed reports and recommendations on *your* water treatment problems.
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How to plan

BOILER ECONOMIZER PIPING

Another in the series of basic piping layouts prepared by Jenkins Bros.

This economizer hookup contributes considerably to high boiler operating efficiency and reduces fuel costs by extracting heat from exhaust gases after they leave the boiler. Because the water entering the boiler feed pump is at low pressure, the temperature is correspondingly low. In order to bring the water as near to boiler temperature as possible before it enters the boiler, it must be brought to boiler pressure, which is the purpose of the economizer.

Water feed to the economizer is controlled by any of the various types of boiler level controls. The one shown here is a thermo-hydraulic generator, in which the water column serves as the generator. The water column consists of two concentric tubes. The inner tube is connected to the boiler drum above and below the water line. The outer tube, which contains a fluid, usually water, is connected to a control valve in the feed water piping. A change in the boiler water level changes the temperature and the pressure of the fluid in the outer tube and operates the control valve hydraulically.

The more efficient counterflow heat transfer, used in this economizer, is preferred to the parallel flow type wherever installation is possible. The water enters the economizer at the bottom and goes out at the top, with the flue gases directed to flow down over the economizer tubes. Pressure relief valves are required on the economizer outlet, and a by-pass allows the boiler to be operated even though some of the tubes fail.

Other types and pressure ranges of Jenkins Valves can be used for this type of layout according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

Copies of Layout No. 40 will be furnished on request. Mail coupon.

Jenkins PRACTICAL PIPING LAYOUTS

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A Use the right type valve for the service.
B Place valves correctly in the line.
C Choose Jenkins Valves for lifetime economy.

40

Fig. 270-U
BRONZE GATE VALVE
Solid Wedge—Inside Screw
Traveling Spindle—Union Bonnet
200 Pounds Steam
400 Pounds O.W.G.

Fig. 270-U, Jenkins Bronze Gate Valve, is recommended for unequalled economy under severe conditions. It has a high quality bronze wedge seating against MONEL seat rings expanded in the body. Wear is taken by the wedge which can be replaced easily. Longer, large diameter threads on manganese bronze spindle reduce wear, permit turning with less effort. Construction throughout is exceptionally rugged.

A CHOICE OF OVER 500 JENKINS VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal.

JENKINS BROS., 80 White St., New York 13, N. Y.

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LOOK FOR THE DIAMOND MARK

SINCE 1864

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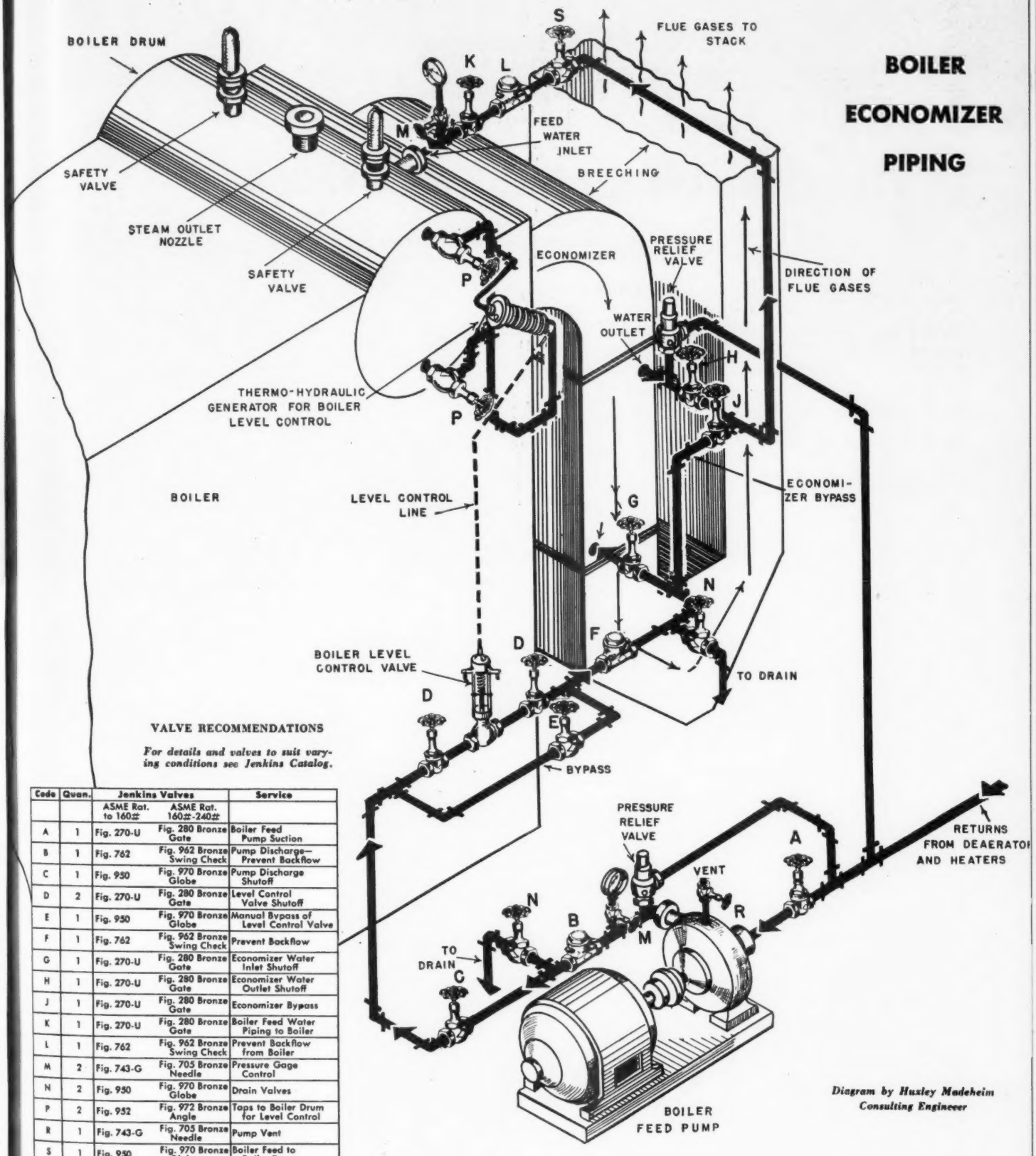
Jenkins Bros

BOILER ECONOMIZER PIPING



VALVE RECOMMENDATIONS

For details and valves to suit varying conditions see Jenkins Catalog.

Code	Quan.	Jenkins Valves		Service
		ASME Rat. to 160#	ASME Rat. 160#-240#	
A	1	Fig. 270-U	Fig. 280 Bronze Gate	Boiler Feed Pump Suction
B	1	Fig. 762	Fig. 962 Bronze Swing Check	Pump Discharge—Prevent Backflow
C	1	Fig. 950	Fig. 970 Bronze Globe	Pump Discharge Shutoff
D	2	Fig. 270-U	Fig. 280 Bronze Gate	Level Control Valve Shutoff
E	1	Fig. 950	Fig. 970 Bronze Globe	Manual Bypass of Level Control Valve
F	1	Fig. 762	Fig. 962 Bronze Swing Check	Prevent Backflow
G	1	Fig. 270-U	Fig. 280 Bronze Gate	Economizer Water Inlet Shutoff
H	1	Fig. 270-U	Fig. 280 Bronze Gate	Economizer Water Outlet Shutoff
J	1	Fig. 270-U	Fig. 280 Bronze Gate	Economizer Bypass
K	1	Fig. 270-U	Fig. 280 Bronze Gate	Boiler Feed Water Piping to Boiler
L	1	Fig. 762	Fig. 962 Bronze Swing Check	Prevent Backflow from Boiler
M	2	Fig. 743-G	Fig. 705 Bronze Needle	Pressure Gage Control
N	2	Fig. 950	Fig. 970 Bronze Globe	Drain Valves
P	2	Fig. 952	Fig. 972 Bronze Angle	Taps to Boiler Drum for Level Control
R	1	Fig. 743-G	Fig. 705 Bronze Needle	Pump Vent
S	1	Fig. 950	Fig. 970 Bronze Globe	Boiler Feed to Boiler Drum

Diagram by Huxley Madeheim Consulting Engineeer

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VALVES

125 TO 600 LBS. STEAM PRESSURE

BRONZE • IRON • STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

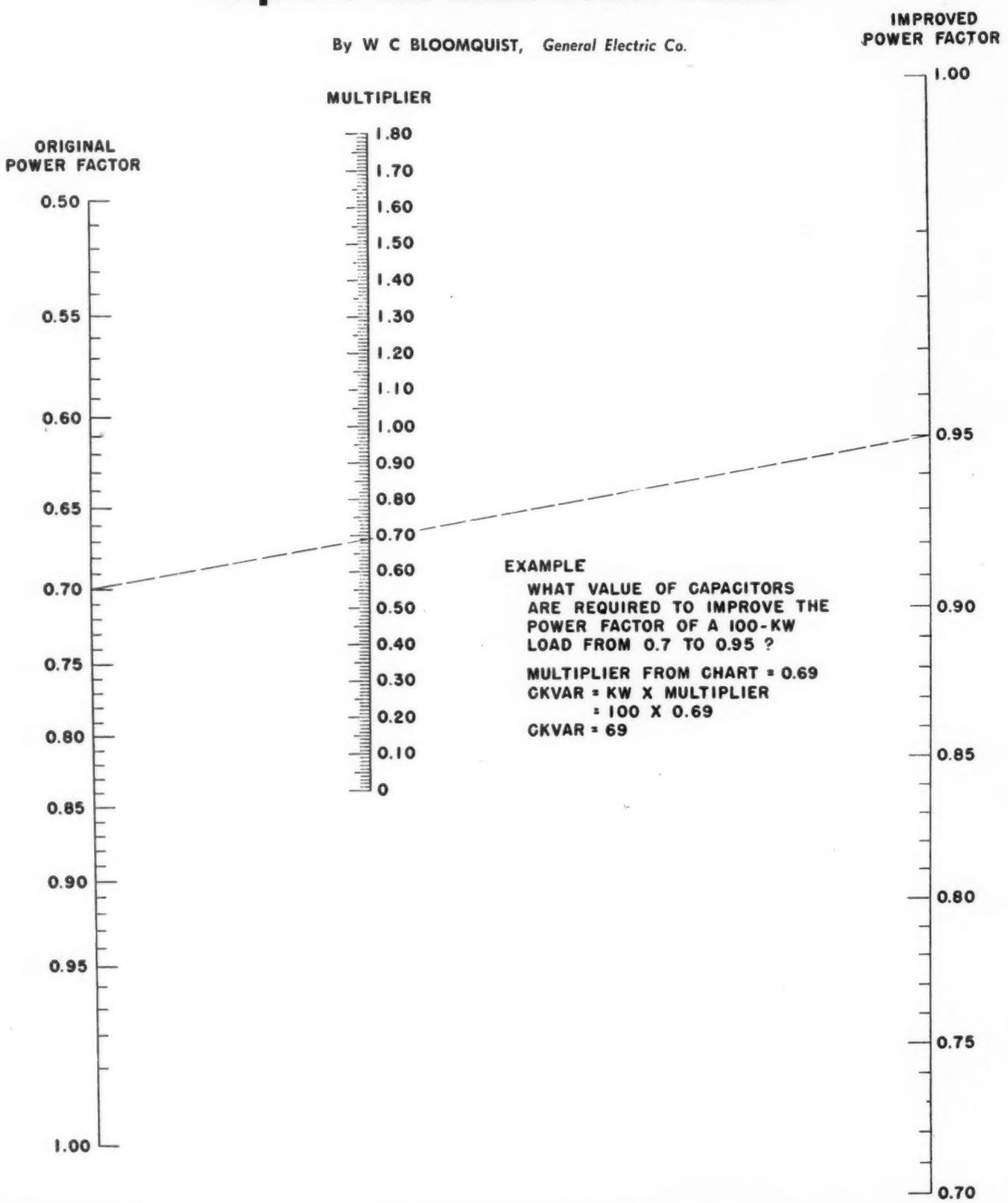
SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

POWER'S DATA SHEETS

Number 196

Improve the Load Power Factor

By W C BLOOMQUIST, *General Electric Co.*



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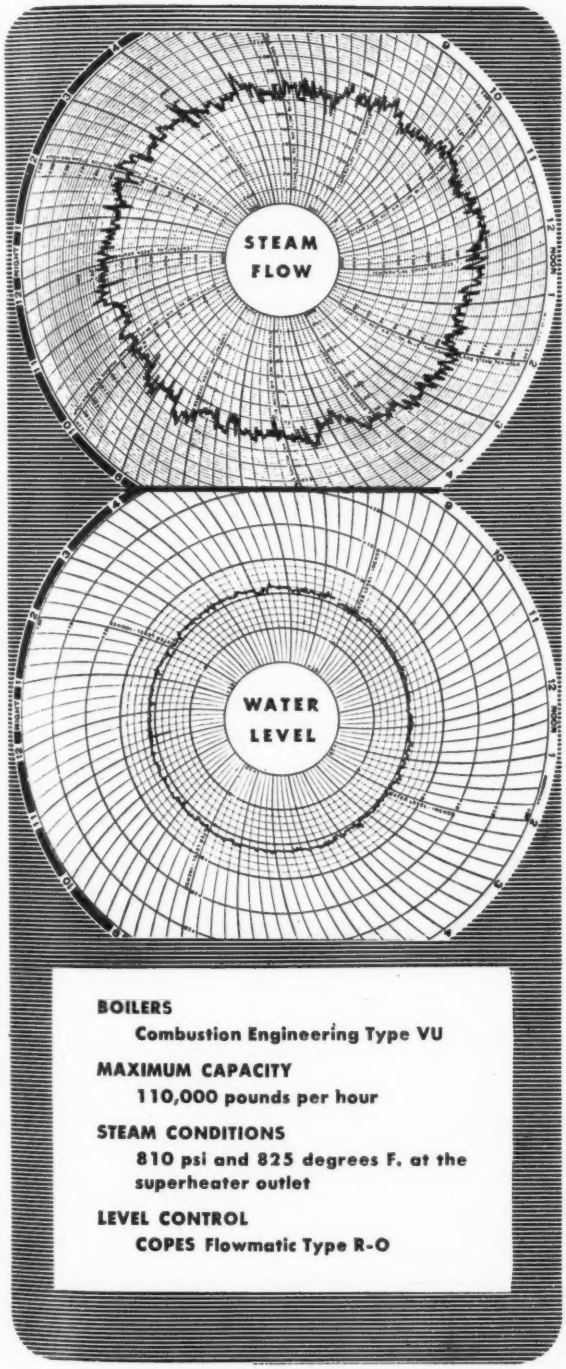
FLOWMATIC *means . . .*

CLOSE WATER LEVEL CONTROL on 810-psi Paper Mill boilers



BOILERS
Combustion Engineering Type VU

MAXIMUM CAPACITY
110,000 pounds per hour

STEAM CONDITIONS
810 psi and 825 degrees F. at the superheater outlet

LEVEL CONTROL
COPES Flowmatic Type R-O

Despite rapidly fluctuating loads—with occasional instant swings of 20,000 pounds per hour—COPES Flowmatics are holding drum water level within extreme limits of plus-or-minus one inch on two C-E Type VU Boilers at a well-known paper mill. Such close control is desirable for any fast-steaming boiler. So is the independence which permits COPES Flowmatic to remain on full-automatic while instruments and other controls are out of service for necessary periodic servicing. Details on request.

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1181 GROVE DRIVE, ERIE, PENNSYLVANIA
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TECHNICAL BRIEFS

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REVIEWED IN THIS ISSUE

VALVES AND PIPES

Valve Characteristics and Process Control

Liquid Flow Characteristics of a Pipeline and a Control Valve

Control-Valve Body Design

OIL USES

Fuel Oil in the Steel Industry

Maintenance of Electrical Oils

Oil Clarification in Steel Plants

High-Temperature Lubricants

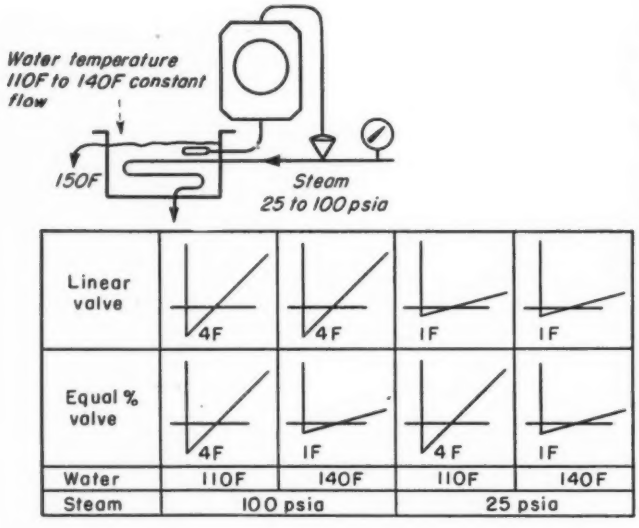
Bearing Seals

RUST PREVENTION

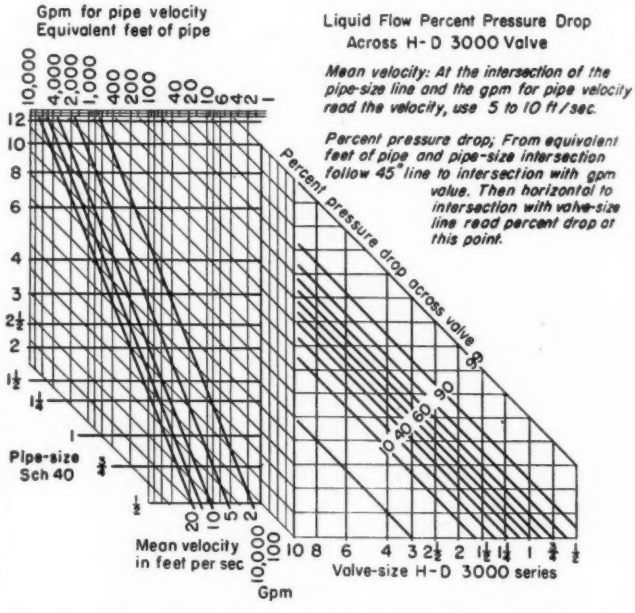
Rust Preventives Maintain Steel

Water Works Maintenance

Directions for ordering papers are given on page 130



1 Comparison between the linear and equal percentage valves shows on a load where water changes 30 F and steam 75 psia


Gpm for pipe velocity
Equivalent feet of pipe
Liquid Flow Percent Pressure Drop
Across H-D 3000 Valve
Mean velocity: At the intersection of the pipe-size line and the gpm for pipe velocity read the velocity, use 5 to 10 ft/sec.
Percent pressure drop; From equivalent feet of pipe and pipe-size intersection follow 45° line to intersection with gpm value. Then horizontal to intersection with valve-size line read percent drop at this point.
Percent pressure drop across valve
Pipe-size Sch 40
Mean velocity in feet per sec
Gpm
Valve-size H-D 3000 series

2 Network chart helps size valves where flow rate, velocity, viscosity, specific gravity, equivalent pipe length are known

VALVES AND PIPES

VALVE CHARACTERISTICS AND PROCESS CONTROL, *by N B Nichols and J G Ziegler, Taylor Instrument Co's.* This discussion of various valves tells how their characteristics fit them for process control. Included are ratio, throttle, V-notch and beveled-disk types. For instance, the so-called poppet valve is of single- or double-seated beveled-disk design. Their nature—globe valves with sliding stems instead of a threaded, hand-operated stem—permits easy use with automatic controls. But this class of valve has essentially a linear flow-lift characteristic; its effective opening area increases in almost direct proportion to the lift of the valve from the seat.

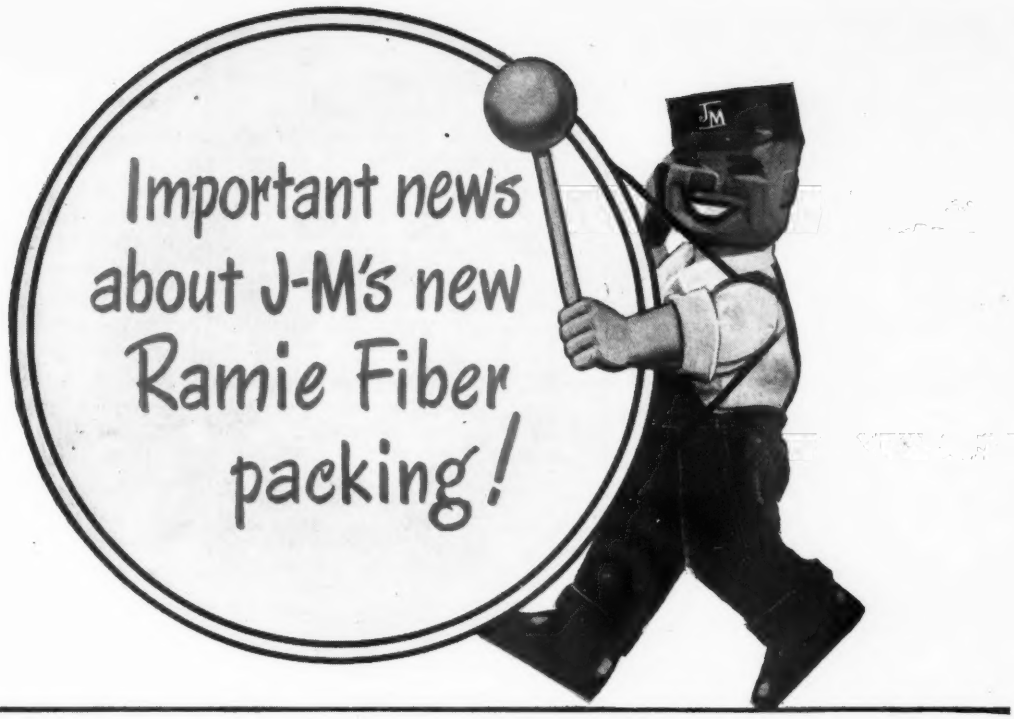
Ideal control for all processes is not necessarily linear so this valve class is limited to those processes where pure linear control applies. A second valve class, one with an equal percentage characteristic, draws its name from the fact that the valve disk is so shaped that a given lift at any opening increases effective opening area a fixed proportion of the total existing. A comparison of these valves is shown in Fig. 1.

A gas-fired oil heater—one sample process of many selected by the authors—maintains a constant outlet-oil temperature by operating a valve in a fuel gas line to the burners. From an analysis of this process and the others, the authors formulate a general rule on valve selection. In brief, these rules make up a simple guide for determining the most desirable control valve for a given application.

Valve characteristics can be overlooked if (1) controller sensitivity is high (2) period of oscillation is short (3) maximum range of load is less than two to one.

An "equal percentage valve" does not apply if (1) controlled medium carries solid particles or will deposit scale (2) maximum load range is greater than about eight to one (3) major load change calls for a linear valve (4) valve lag accounts for most of effective process lag. *ISA Paper No. 48-2-1.*

LIQUID FLOW CHARACTERISTICS OF A PIPE LINE AND A CONTROL VALVE, *by Otto Kneisel, Hammel-Dahl Co.* Sizing of all control valves by slide rules or alignment charts, based on pressure drop across them, disregards the characteristics of the line in which the valve is to be installed. This paper sets up a network chart to solve any specific control-valve problem in a liquid-flow system requiring pipe size, valve size, pressure drop across the line and across the valve, flow rangeability and flow characteristics. Basic data necessary for a starting point are: (1) flow rate, gpm (2) specific gravity of liquid involved (3) viscosity (4) equivalent length of



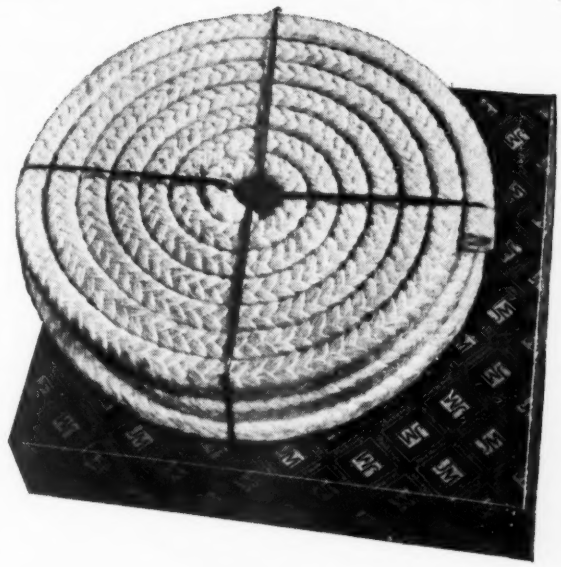
NAVALON lasts longer because it contains more lubricant and retains more lubricant

Navalon is important news to you . . . because it is a superior new packing for cold liquid service . . . another development of the J-M Research Laboratory.

Navalon—made of ramie, the strongest of all natural fibers—outlasts other packings because it *contains* more lubricant to begin with . . . and because it *retains* more lubricant in service.

Navalon is abrasive-free and rot-resistant . . . delivers outstanding performance on pumps, elevators, accumulators, presses, and reciprocating rods and plungers . . . operating against fresh or salt water, brine, cold oil and other liquids.

Navalon, the new ramie packing for cold liquid service, is another example of the continuing research at J-M that brings you better, longer-wearing packings for every service condition. See your Distributor—or write Johns-Manville, Box 290, New York 16, N. Y.



JOHNS-MANVILLE JM PRODUCTS

Johns-Manville **PACKINGS & GASKETS**

pipe in feet (5) permissible line velocity.

Certain terms used in solving the problem are defined, such as flow characteristic (the relation of flow rate to valve lift at a constant pressure drop); flow coefficient (flow rate in gpm of water divided by the square root of pressure drop in pounds per square inch where the Reynolds member of the flow is greater than 4000 and the liquid does not vaporize within the line).

After once establishing conditions, factors and terms such as the above, the author goes to a prepared network chart (shown in Fig. 2 on page 128) on which appear factors and figures that are required for solution of the problem. *ISA Paper No. 48-2-3.*

CONTROL VALVE BODY DESIGN, *by Donald P Eckman, Cornell University, and R B Werey, Conoflow Corp.* Any ideal automatic control valve should meet these requirements: (1) easy maintenance (2) smooth and consistent calibration of lift versus flow at all differentials (3) reasonable flow capacity at an economical size.

Further points are (1) Control valves differ from conventional gate and globe valves in three ways. First control valves are positioned from an external source of power while hand valves are, in general, positioned by handwheel and screw stem. (2) Present-day control valves usually have a balanced inner valve whereas hand valves are single-seated with an unbalanced inner valve. (3) Control valves are designed to pass a given flow for a given pressure differential while gate valves are designed to pass a maximum flow at a minimum pressure differential.

With the above requirements and characteristic differences between classes of valves established the authors go on to discuss ideal flow conditions, pressure loss, actual flow conditions and finally factors influencing valve selection.

In summary, the problem of a fluid flow through a control valve is not a simple one. Reliance must be placed upon flow data at operating conditions. And this data cannot be safely extrapolated at high differentials.

The double-ported balance valve and the conventional single-seated globe pattern leave much to be desired when it comes to body losses. It is evident that desirable flow characteristics at high differentials do not necessarily follow just because they are good at low differentials. More thought should be given to streamlining body design, claim the authors. *ISA Paper No. 48-2-2.*

To Obtain Complete Text

Material in these briefs comes from one of two sources:

Instrument Society of America, Third National Instrument Conference and Exhibit, Philadelphia, Pa. Sept 13-17, 1948. Papers are identified by ISA and paper No. Available at Instrument Society of America, 1117 Wolfendale St, Pittsburgh 12, Pa.

Association of Iron and Steel Engineers, Annual Convention, Cleveland, Ohio, Sept 28-Oct 1. Papers identified by AISE. Available through Association of Iron and Steel Engineers, 1010 Empire Bldg., Pittsburgh 22, Pa.

OIL USES

FUEL OIL IN THE STEEL INDUSTRY, *by A J Fisher, Bethlehem Steel Co.* Steel-industry trends in using fuel oil are discussed. Tables show the estimated mineral-fuel reserves of the U. S., world crude-oil production, U. S. refining input-output, and detailed distribution of gasoline, kerosene, distillate fuel oil and residual fuel oil in the U. S. for the past several years.

Steps necessary to change a fuel-oil-consuming integrated steel plant to a complete coal basis are outlined. There are many typical applications of fuel-oil burning showing burners, control and instrumentation. *AISE Paper.*

CLARIFICATION OF OIL IN STEEL PLANTS, *by Charles M Ambler, The Sharples Corp.* Utility of any lubricant is reduced by the impurities it picks up under service conditions. Unless the same critical attention is given to its purification as to its original selection, results during its use are not optimum. Centrifugal force is particularly suitable for removal of the kind of impurities normally picked up by oils in steel-mill service.

Difference between gravity and centrifugal force is one of degree, and the operating principles of centrifuges are described in terms of their gravitational equivalents.

Various combinations of centrifuges with heaters, pumps, gravity tanks and filters are available for the purification of lubricating oils, cutting oils, quenching oils, hydraulic oils, insulating oils and palm oil. These combinations are illustrated and their operating principles discussed. *AISE Paper.*

PREVENTIVE MAINTENANCE OF ELECTRICAL OILS *by C J Egger, Bowser, Inc.* Chemical action as well as pollution of electrical oils occurs if the oil is employed where external agents are in close association with substances that react or catalyze chemical reactions. It has been established that the presence in solution of oxidation products results in a decrease in dielectric strength approximately paralleling the increase in concentration of dissolved substances. Deposition of resinous compounds upon the cores and windings of transformers prevents adequate heat transfer through oil, and also retards free circulation.

Perfect solution to the problem is to eliminate the conditions creating it. Several objectives seem to be reasonably indicated and may be expressed thus:

1. Oil for a specific application should be the most stable and oxidation-resistant that is available or can be developed.

2. Conditions of operation and design should be so controlled that the operation of the mechanism should not give rise to or promote changes in the composition or constitution of the oil.

3. Means should be provided for removal of the external agents such as air, water or other products entering into or necessary for undesirable chemical changes. *AISE Paper.*

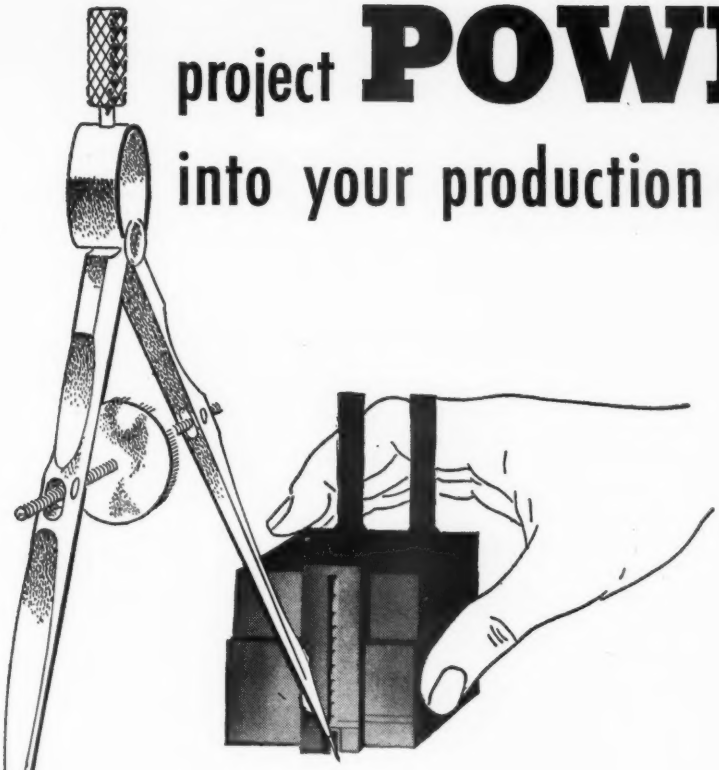
RUST PREVENTION

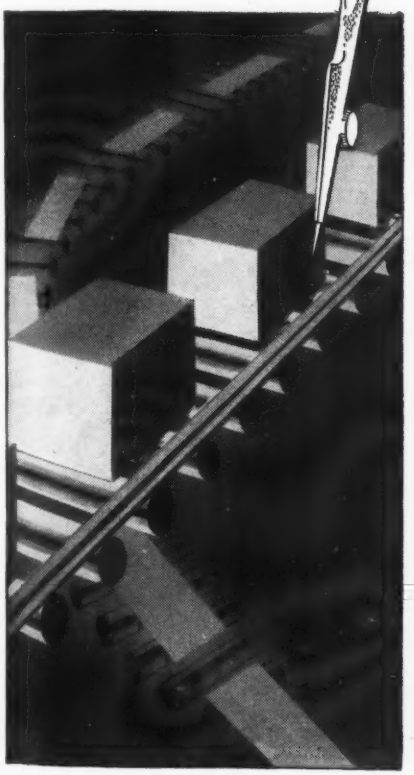
RUST PREVENTIVES HELP MAINTAIN STEEL STRUCTURES, *by Joseph G Surchek, Dearborn Chemical Co.* This paper deals with the petroleum-base, nondrying protective coatings that have found acceptance in industry to protect steel structures under various adverse weathering conditions. Because of their inherent properties of flexibility, high wetting power and waterproofness, these materials are applied if hard-drying protective coatings are not practical.

Some of the most effective of these materials, namely the high-melting-point waxy ones, were formerly restricted in use because of application difficulty. It is now possible to apply these materials quickly and effectively with heat and fluid pressure. This method can be used on flat surfaces or in a restricted area such as pipe interior. An interesting method of application to interior of water pipe is discussed. Soft or waxy greases can be applied easily by high-pressure atomizing equipment now commercially available. Various unique applications of these materials are discussed. *AISE Paper.*

(*Continued on page* 140)

project POWER into your production planning





Since modern production planning requires projection of a program over a long period of time it's quite logical that power requirements will be based on a similar long-range study of peak demands for all of the industrial services supplied by modern boiler and power plants.

Because power plant construction, expansion, or modernization does require advance planning *after* your Consulting Engineers have completed their specifications and detail drawings, it's never too early to call in Dravo Power Plant Specialists. When you draw upon Dravo experience during prior planning you can be assured that power and boiler plant construction will be completely integrated with the over-all project—you can schedule your future power requirements and depend upon Dravo to maintain the construction pace to meet those schedules.

There are important advantages to be gained when Dravo contract methods and construction techniques are applied to your power or boiler plant projects. Additional details of these methods and techniques are reviewed in Bulletin GB-504.

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Derrick Boats • Crane Cab Coolers • Open Steel Flooring • Concrete Aggregates • Inland River Transportation

POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

Conference on Nitrogen Removal From Natural Gas

▶ PRACTICAL AND ECONOMICAL METHODS of removing excess nitrogen to improve heating qualities of natural gas and permit recovery of other salable hydrocarbon products were discussed in Amarillo, Texas, during a recent 2-day conference of nearly 100 gas engineers and executives of operating and research departments of major gas-pipeline and related companies. The conference emphasized several benefits of removing excess nitrogen from natural gas at its source in the field. Aside from improved heating quality of natural gas, removal of nitrogen would increase capacity of long cross-country pipelines in terms of measured heating units of fuel, eliminate a noncombustible element in natural gas, and allow extraction of such heavy hydrocarbons as propane and butane for separate sale.

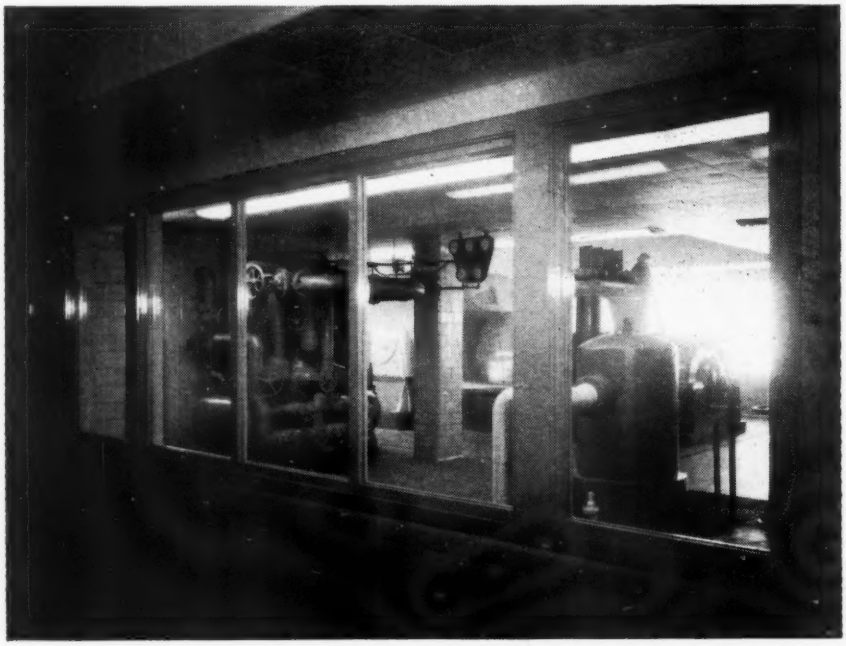
Work on the nitrogen-removal problem is being conducted by Bureau of Mines at its Amarillo helium plant. Natural-gas dept of American Gas Assn is cooperating through its technical and research committee.

Power Show to Present Many Plant Innovations

A long list of innovations designed to improve performance of power plants is assured for the 18th National Exposition of Power and Mechanical Engineering, scheduled at Grand Central Palace, New York, N. Y., Nov 29 to Dec 4. This is made known through filing of plans for their exhibits by a substantial number of manufacturers who have already contracted for space.

Among the new developments that visitors at the exposition will see is a 2000-hp fluid drive capable of pumping a million pounds of water an hour into a high-pressure boiler. Another exhibit will feature a type of steam-turbine centrifugal marine boiler-feed pump that is said to have made an almost clean sweep in tankers since its intro-

(*Continued on page* 174)



Insulating Glass Performs Double Duty at Utility

At Industrial Canal Station of New Orleans Public Service, insulating glass keeps window, in the wall separating control and turbine rooms, free from condensation and kills machinery noise. Also, plant engineers and visitors have full view of working turbines and generators. Specified for the installation was Thermopane, an insulating glass made by the Libbey-Owens-Ford Glass Co. Double panes of plate glass, with sealed dehydrated air space between, make up the units for the installation. Temperatures on one side of the window wall range 95 to 110 F, while on the other, where air conditioning is employed, the temperature is normally 73 F

COMING EVENTS

Nov 3-4—American Society of Mechanical Engineers, fuels div meeting, held with American Institute of Mining Engineers, Greenbrier Hotel, White Sulphur Springs, W. Va. O B Schier, 29 W 39th St, New York 18, New York.

Nov 3-5—American Institute of Electrical Engineers, southern district meeting, Tutwiler Hotel, Birmingham, Ala. H H Henline, secretary, 33 W 39th St, New York 18, N. Y.

Nov 28-Dec 4—American Society of Mechanical Engineers, annual meeting, Pennsylvania and New Yorker Hotels, New York, N. Y. Ernest Hartford, executive assistant secretary, 29 W 39th St, New York 18, N. Y.

Nov 29-Dec 4—18th National Exposition of Power & Mechanical Engineering, Grand Central Palace, New York 17, N. Y. Charles F Roth, manager, Grand Central Palace, New York.

Dec 5-8—American Society of Refrigerating Engineers, meeting, Statler Hotel, Washington, D. C. W S Woodside, 801 Whittaker Bldg, Baltimore, Md.

Jan 10-14—Third National Materials Handling Show, jointly sponsored by American Society of Mechanical Engineers and Material Handling Institute, Convention Hall, Philadelphia. Banner & Greif, 250 W 57th St, New York 19.

Jan 24-28—International Heating & Ventilating Exposition, International Amphitheatre, Chicago, Ill. Charles F Roth, manager, Grand Central Palace, New York 17, N. Y.

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Meet All Requirements for Modern High Pressure, High Temperature Service

ANY engineer responsible for the design or operation of modern high pressure, high temperature steam plants can safely provide the benefits of completely automatic condensate drainage by specifying Armstrong Forged Steel Steam Traps. Their inherently trouble-free design plus highest quality materials and workmanship assure safety and dependable performance. There is no chance of failure to open when condensate fills the trap and no steam loss under no-load conditions. The extensive line includes traps to meet any pressure, temperature or capacity requirements.

Armstrong Forged Steel Traps are also ideally suited to low and medium pressure service where "all-steel" installations are desired.

Where quality, safety and dependability come first, specify ARMSTRONG, the "standard" in many high pressure plants throughout the world. For more complete information and prices, consult your nearby Armstrong Representative or write:

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LIST OF MATERIALS

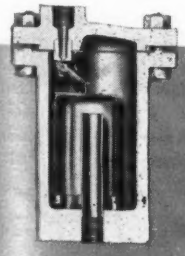
CAP AND BODY FORGINGS:
Up to 600 psi—SAE 1030 steel
600 to 900 psi—ASTM F-1 moly. steel.
900 to 2400 psi—ASTM F-3 chrome moly. steel.

VALVE AND SEAT:
Chrome steel, heat treated.

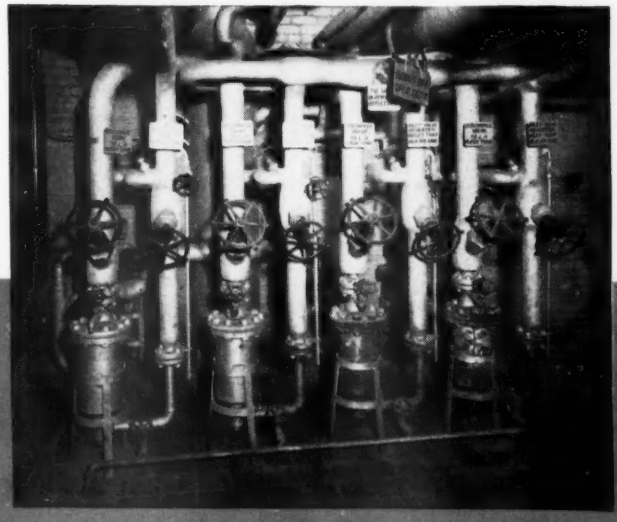
BUCKET AND VALVE LEVER ASSEMBLY:
18-8 Stainless Steel.

BOLT AND NUT SET:
Bolts supertemp steel, 149,000 lbs. tensile:
Nuts, hex, semi-finish, S.A.E. 1030.

GASKET:
Compressed graphited asbestos.



SEND FOR the 36-page ARMSTRONG STEAM TRAP BOOK for complete data on sizes, capacities, selection, installation and maintenance of Forged Steel and Cast Semi-Steel steam traps.

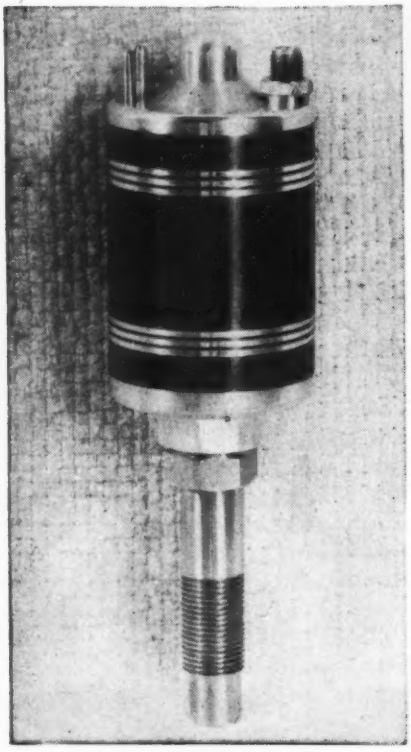


Wisconsin Electric Power Co., Port Washington Station

ARMSTRONG *Forged Steel* STEAM TRAPS

and ground, permitting direct mounting on grounded panel.

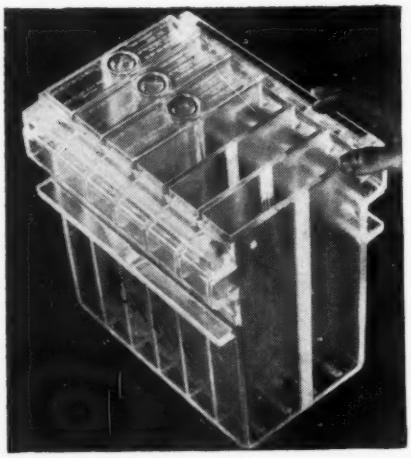
Device has straight-line vertical action and is equipped with double-brake silver-to-silver contacts, eliminating flexible leads. These reversing contactors are suitable with ac polyphase motors rated not more than 1 hp and with ac single-phase and dc motors up to ¾ hp. **Industrial Controller Div, Square D Co, 4041 N Richards St, Milwaukee 12, Wis.**



Indicator Pressure Element E471

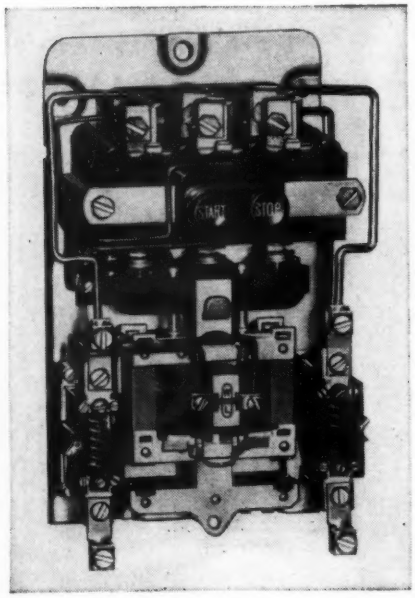
TYPE 5 ELEMENT replaces Type 3 pressure element and Type 3 gas-sampling valve. It can thus be used with both Cox direct-pressure engine indicators and Cox gas-sampling units. It is now available plain or with a built-in spark plug, which eliminates need for a special opening into the pressure chamber. Type 5 is 40% lighter and will permit taking an indicator card for a complete cycle in one-third to one-fifth time required by former types.

Type 5 is made exclusively with poppet valve that opens outward or toward compression or combustion chamber. Thus spring pressure alone is no longer depended on for sealing when valve is shut. Actuating solenoid is powerful enough to open valve against highest pressures encountered in internal-combustion engines. Type 5 requires no cooling in normal engine installations. Engine indicator has a linear calibration unaffected by element temperature. **Commercial Research Laboratories, Inc, 20 Bartlett Ave, Detroit 3, Mich.**



Storage Battery E440

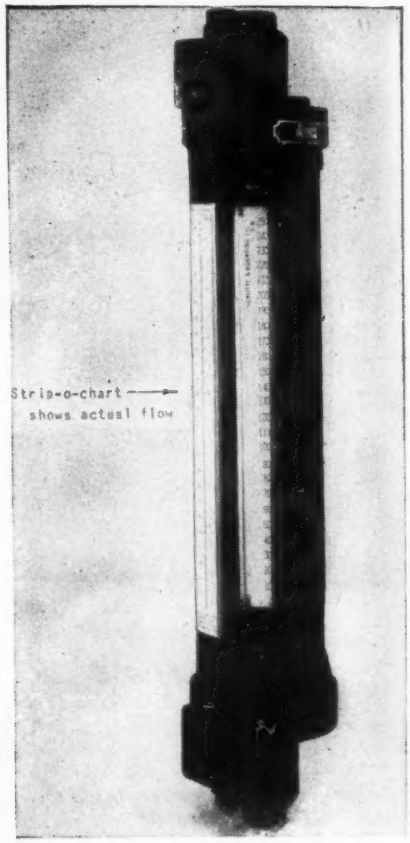
HOUSED IN A TRANSPARENT polystyrene plastic case, this battery, rated at 24 v, is capable of producing 15 hp for 3 min. Connections are provided for venting gas automatically on charge and discharge, and a "no-overflow" device to prevent over-filling. Complete operating instructions are molded into plastic case. **Electric Storage Battery Co, Philadelphia, Pa.**



Magnetic Starter E443

A SOLENOID-OPERATED STARTER is intended for general use where across-the-line, non-reversing starting of polyphase squirrel-cage induction motors and single-phase motors is permissible. Featuring high arc interrupting capacity, compact unit construction, reliable thermal overload protection and double-brake silver-to-silver main contacts, the starter may be controlled by separate pilot devices or with local pushbuttons.

Units have a maximum enclosed rating of 25 hp, 440-550 v, 3 phase, 60 cycles. Standard operating coils can be supplied for 110, 208-220, 440 and 550 v, 25- or 50-60-cycle service. Dual voltage coils are available for 110/220 or 220/440 v, 60-cycle operation. **Ward-Leonard Electric Co, Mt. Vernon, N. Y.**



Meter Scale E419

STRIP-O-CHART is designed for attachment to *S K Rotameters* with rigid cast-iron tube frames to provide a convenient direct-flow reading chart and eliminate the need for separate calibration charts. *Strip-O-Chart* will be made to customer specifications and will contain the P O, calibration units and other identifying information. **Schutte & Koerting Co, 12th & Thompson St, Philadelphia 22, Pa.**

Circulating Pump E463

THIS NEW 2-POSITION PUMP may be mounted in either horizontal or vertical position by manipulation of only four bolts. Transmission of vibration is eliminated by a special rubber coupling with brass inserts

(*Continued on page* 146)

Use convenient reply cards on page 178a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

For Heavy Duty Steam Generating Plants

Springfields'

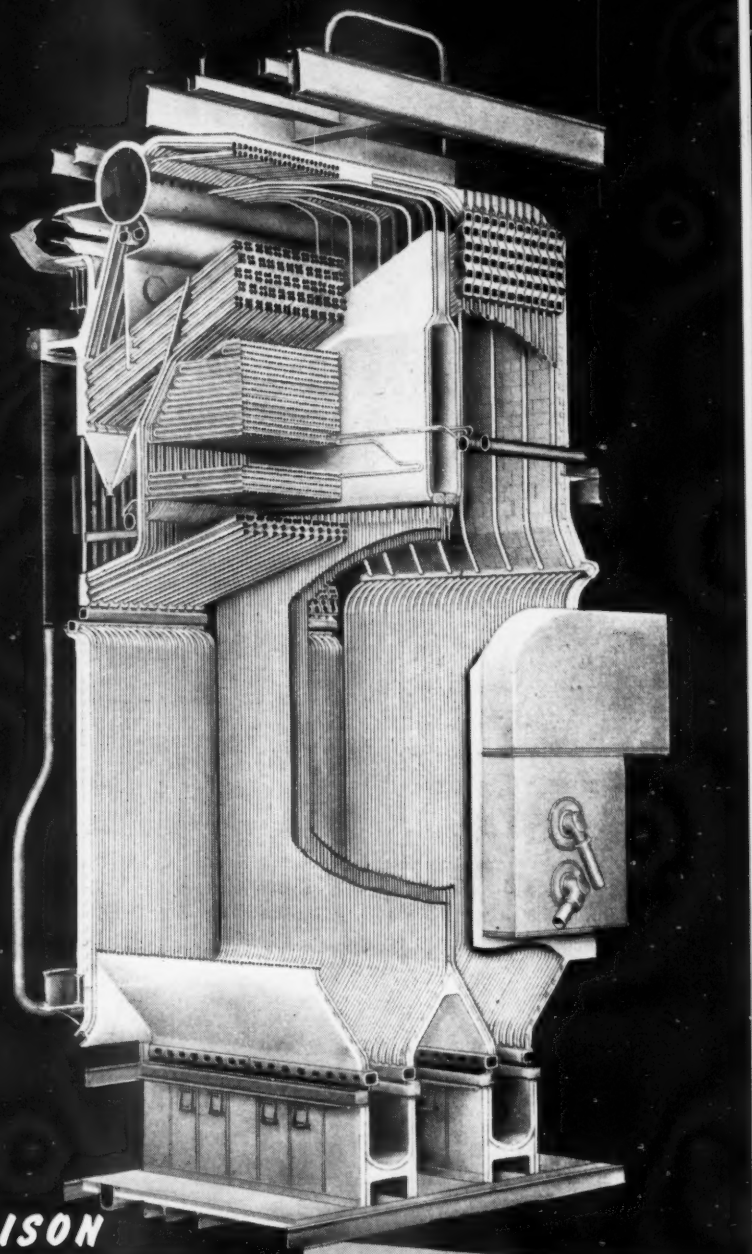
DIVIDED FURNACE WITH CENTER WATER WALL

THE divided furnace with a CENTER WATER WALL* is a development first introduced by Springfield Boiler Co., for large central station installations. It has application where gas temperatures entering the first pass and superheater must be limited to prevent overheating of the center section of the wider furnaces. It enables a unit to stay on the line longer before shutting down for maintenance and cleaning.

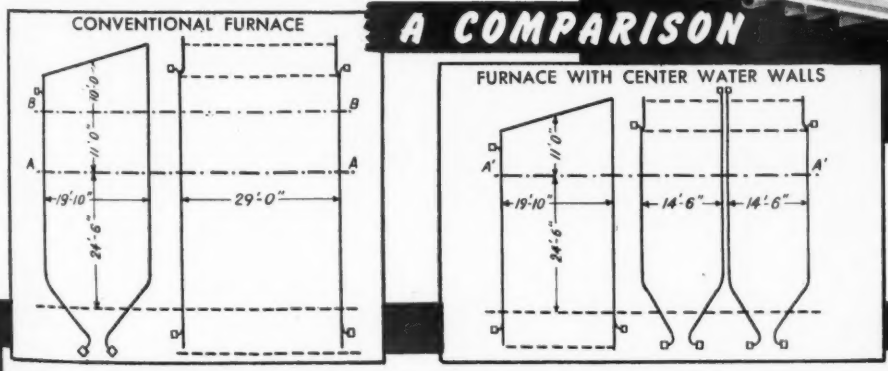
The divided furnace construction has been highly dependable and successful in service. It is adaptable to any kind of firing. Springfield offers it on both bent tube and straight tube boiler designs.

*Patented

CHECK WITH YOUR CONSULTING ENGINEER ON YOUR MODERNIZATION AND NEW PLANT PROJECTS



A COMPARISON



These diagrams show how the *center water wall* made it possible for Springfield to reduce the height of furnace 22% on one 350,000 lb. pulverized coal fired unit in addition to securing a more even gas temperature entering the first pass across the width of the unit.

SPRINGFIELD PRODUCTS

BENT TUBE STEAM GENERATORS—Modern designs for capacities from 10,000 lbs. up.

STRAIGHT TUBE BOILERS—Specially designed for capacities from 5,000 to 450,000 lbs. per hour and higher.

STANDARDIZED TYPE M BOILERS—Standardized for quicker delivery and lower cost. Sizes 6,000 to 17,000 lbs. per hour.

WATER COOLED FURNACES—Heavy duty water walls. Exclusive center water wall construction for larger units.

SUPERHEATERS — AIR HEATERS — ECONOMIZERS—Individually designed to meet requirements.

SPRINGFIELD BOILER CO.

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Electronics

(*Continued from page* 108)

Coils wound in air, Fig. 17, because of their low reactance are generally suitable only for high-frequency circuits, such as choke coils to deflect a lightning stroke from a power line or for high-frequency heating coils.

Reactor coils used in electronic circuits usually have a laminated iron or steel core, Fig. 18, because the magnetic flux in these materials is about one thousand times as great as in air or most other materials. Usually the core is a complete loop, which gives a maximum inductive reactance for a given number of turns, core cross section and frequency in cycles per second.

The next article will describe some of the different kinds of inductive reactors and transformers used and applications in electronic circuits.

Electronic Control

(*Continued from page* 101)

with thyratron exciters for generator and motor fields. Power circuits are the same as in Fig. 3, but exciter set is omitted. In place of amplidyne, a pair of thyratron tubes connected as a half-wave rectifier, convert ac to dc power for supplying generator shunt field excitation. In a similar manner, another pair of thyratrons serve to excite dc motor shunt field.

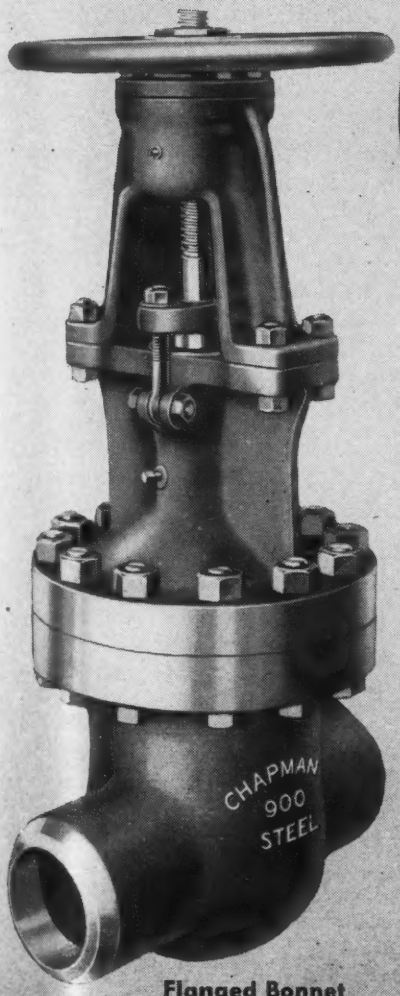
Thyratrons are gas-filled rectifier tubes with grid control. A bias voltage, applied to grid, controls firing angle of tube during each positive half-cycle, and consequently the average dc current passed by rectifier. Thus grid control of thyratrons can be utilized to control dc motor speed. Speed control of the system is obtained by an electronic speed regulator, which acts on generator field rectifier and, in addition, if field weakening control of dc motor is desired, on motor field rectifier also. Closed-cycle control is realized by coupling a tachometer generator to dc motor, the speed signal of which is compared in the regulator to a standard.

Grid control of thyratron tubes is handled by phase-shift networks, one form of which is shown in Fig. 8. Grids are connected to secondary of a grid transformer whose midpoint is connected to cathode potential; grid-cathode voltage is thus in phase with

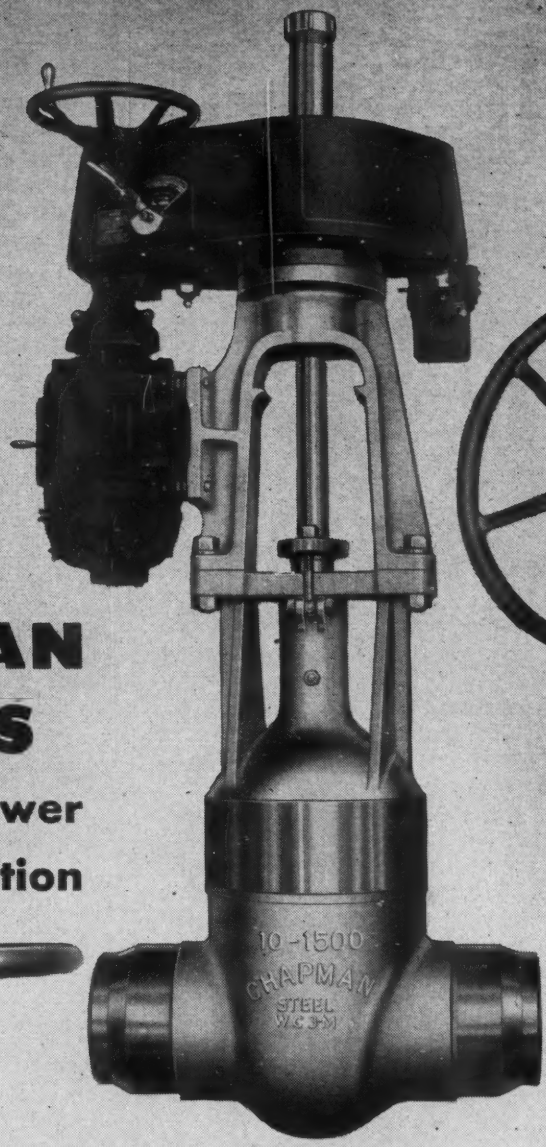
See all 3 types at
the Chapman Exhibit
THE POWER SHOW
Booths 46 and 47

CHAPMAN VALVES

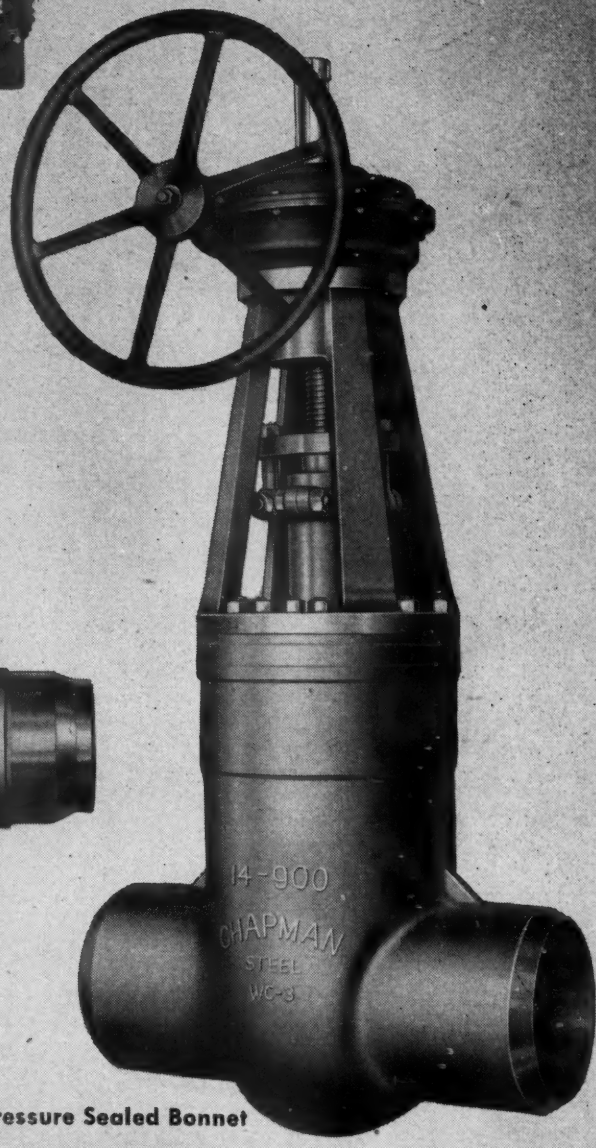
Meet Every Power Plant Specification



Flanged Bonnet



Welded Bonnet



Pressure Sealed Bonnet

Chapman builds valves to meet every power-plant specification—every pressure and temperature range. Chapman high pressure valves are available IN THREE TYPES of body and bonnet connections . . . welded, pressure sealed or flanged. All have straight-through ports and are manufactured to full A.S.A. standards for port diameters and wall thicknesses.

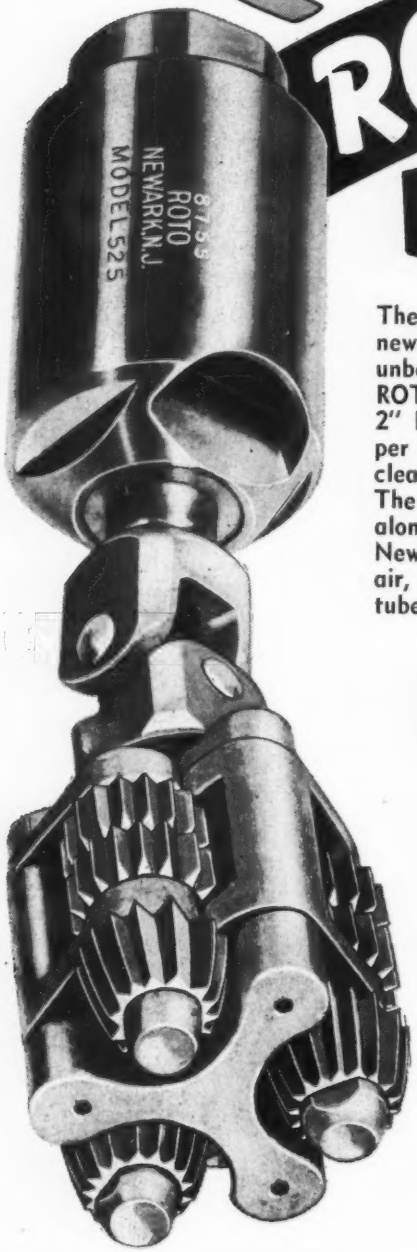
The Chapman Valve Manufacturing Co., Indian Orchard, Mass.

Unequalled Speed

IN THE AIR

ROTOJET

for tube cleaning



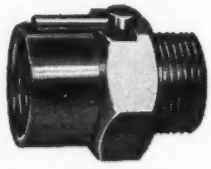
Model C-525 ROTOJET Air-driven Motor with swing frame head and universal joint for 2¾" - 3½" I.D. curved tubes.

The tremendous power developed by the new ROTOJET enables it to clean tubes at unbelievable speed. On one recent job, a ROTOJET Model 505 cleaned badly scaled 2" boiler tubes at the rate of 5 minutes per tube in one pass, while ordinary tube cleaners required two passes and 20 minutes. The time and labor saved on this one job alone, more than paid for the ROTOJET. New ROTOJET models for operation with air, water or steam are stocked for most tube sizes. Send for new bulletin.

ROTOJET

Air-driven

TUBE CLEANERS



Roto Air Valve for curved tube cleaners.

Roto Air Valve Saves Labor

By installing an inexpensive Roto Air Valve directly behind the motor, tube cleaning becomes a one-man job, eliminating a helper and speeding up the cleaning. Made for all straight and curved air-driven tube cleaners.

ELLIOTT COMPANY-ROTO DIVISION

153 Sussex Avenue **Newark 1, N. J.**

secondary voltage of grid transformer. A phase-shift network, Fig. 7, determines phase angle of voltage impressed on grid transformer.

Electronic regulators act on dc excitation of a saturable reactor. A standard voltage, which is the drop across a speed-setting potentiometer, is compared to speed signal from tachometer generator. Differential voltage is then fed into an amplifier, which passes current through dc coil of saturable reactor. This regulates firing angle of thyratrons and maintains desired speed. Current-limit control can be superimposed by feeding drop across motor and generator commutating fields into amplifier.

Applications. Industrial drives have successfully used both amplidyne and thyratron exciter systems. As far as performance is concerned, they are equivalent. Choice of one or other system is largely governed by requirements of drive, size of rotating machines, range and accuracy of required speed control. A detailed study of a particular application should be made to determine which system is more economical.

Talleyrand Condenser

(*Continued from page* 81)

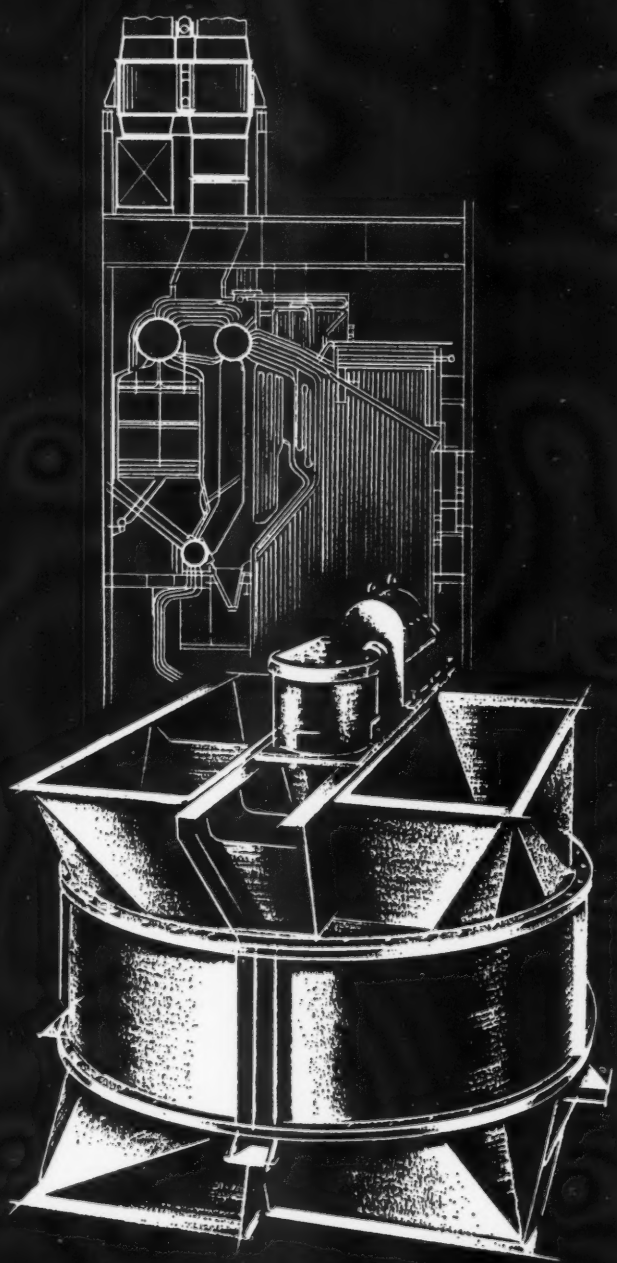
Through the efforts of the Talleyrand Engineering Laboratory detailed plans were completed Nov 20, 1947 to replace the hydraulic control features of the chlorinator with a simple air-operated set designed to eliminate many features of water-operated control. Fouling of ports and passages along with corrosion of important parts was inherent in the water controls. Air operation simplifies design, reduces the number of controls giving smooth, reliable operation with an increased safety factor.

Corrosion Reduction. Chlorination also leads to reducing condenser-tube corrosion. When porous deposits. such as bits of decomposing wood, cloth. paper, fish, algae growths or corrosion products, are in contact with a uniformly filmed surface of tubing, the film beneath the deposit may break down and permit highly localized corrosion.

The extreme variation in all factors concerning condensers often places a time limit on the value of solutions to given problems. Records of condenser operating and maintenance facts should be kept in detail to enable attacking any situation with an informed attitude. At Talleyrand we started this practice 25 years ago with profitable results.

Acknowledgments. The authors ac-

Designed for Preheat when heat recovery must be pushed to the limit



With the Ljungstrom Air Preheater, it is practical to reach low exit-gas temperatures.

While plans for steam generation plants are under consideration, investigate the possibilities of the Ljungstrom. The specialized experience of Air Preheater engineers is at your disposal, to aid in effecting the most economic heat recovery from flue gases.

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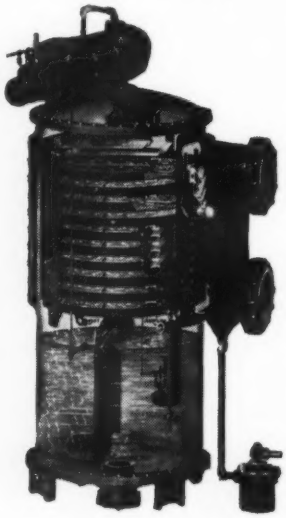
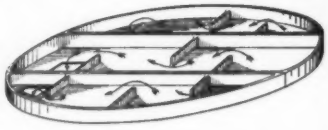
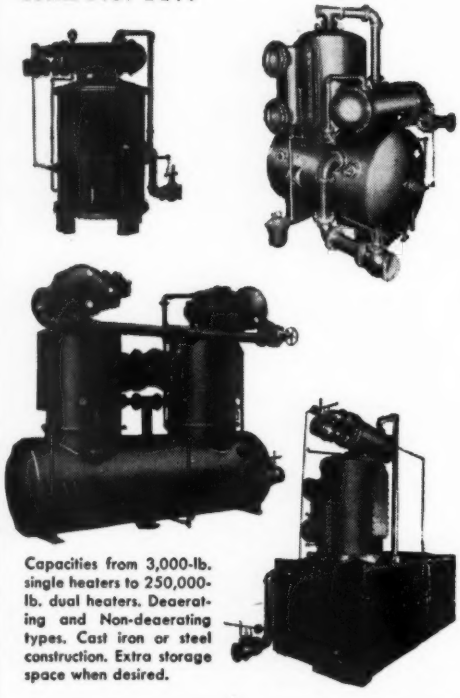


Raw makeup water enters heater at top and travels downward by flowing over a series of open coils, permitting transfer of heat from steam which fills the chamber. Lime and magnesia released and deposited on coils or pans. Oxygen and other non-condensable gases are eliminated.



Water flows in thin film, and in tortuous courses, over pans, and falls in thin streams and small drops, making transfer of heat from steam to water rapid. Condensation of steam used in heating becomes one-sixth of boiler feed supply.

● Consulting engineers who have watched their performance and steam engineers who have had them as equipment are alike impressed with the advantages of Stickle Feed Water Heaters and Purifiers. Stickle Open Coil Design assures effective results in daily operation, obviates upkeep cost, and makes possible a long and satisfactory service life. Ask for Bulletin No. 117.



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knowledge their indebtedness to all their associates whose work has enabled the preparation of this article, particularly to Walter E Drew and J D Kennedy.

Technical Briefs

(*Continued from page* 130)

WATER WORKS MAINTENANCE, *by George H Dann, Philadelphia Suburban Water Co.* Maintenance of a waterworks system starts the day the water system is placed in service.

Leak Surveys—Immediately the question arises of maintaining the system as near to its original condition as possible. Because a method of checking leakage is of primary importance, it is necessary to have a complete piping layout of your plant. If this piping plan is not available, there are pipe locators to locate these underground structures.

Loss of Head Tests—It is also possible, by means of a pitometer rod and a U-tube with pressure gages a known distance apart and with their elevation correlated, to develop a hydraulic slope which will indicate bottlenecks such as partly closed valves, corroded fittings, undersized pipes and other maladies known to the plant engineer.

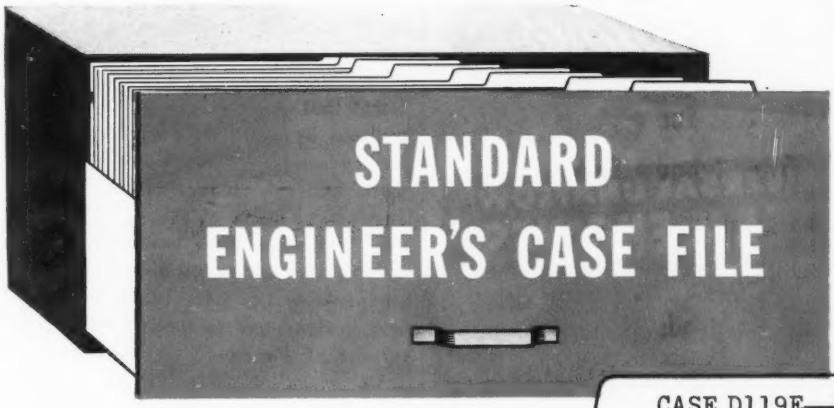
Cleaning and Coating—If by tests it is found that a pipeline has lost a sizable amount of its original carrying capacity, it is feasible to clean and coat this pipe, bringing the carrying capacity to a point that is comparable to its original condition.

Standpipe Painting—Steel water tanks should receive careful annual inspection. Paint has been and still is a proved method for the protection of steel tanks.

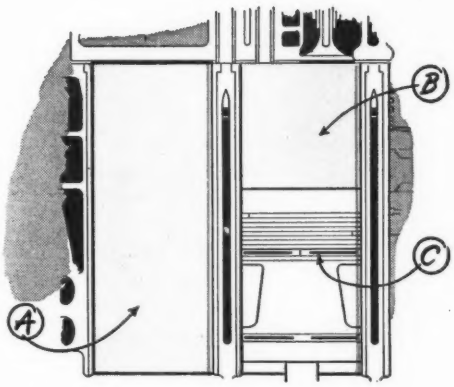
Electrolysis and Corrosion—Corrosion has varied phases. There is the electrolysis or corrosion due to stray railroad currents; there is corrosion caused by sulphate-reducing bacteria; differential aeration is another cause of serious corrosion, and also differences in acidity. *AISE Paper.*

OIL USES *Contd from p* 130

BEARING SEALS, *by R A Kraus, Republic Steel Corp.* With the continued progress in design of higher-capacity plain and antifriction bearings, as well as the steadily mounting working pressure and scope of application of hydraulic devices in heavy industry, all too frequently the necessary sealing devices



CASE D119E—REDUCING WEAR ON LINERS IN DIESEL ENGINES



DIESEL ENGINE LINERS AND PISTON

In high-speed Diesel engines lubricated with RPM DELO Diesel Engine Lubricating Oil, wear on liners was held to a minimum with little variation over their entire areas. A constant lubricating film was maintained on them even in high-temperature belts. RPM DELO Oils are recommended for all types of Diesels. Come in all viscosity grades necessary for your engines.

A. Special additive provides metal-adhesion qualities...keeps oil on all parts whether hot or cold, running or idle.

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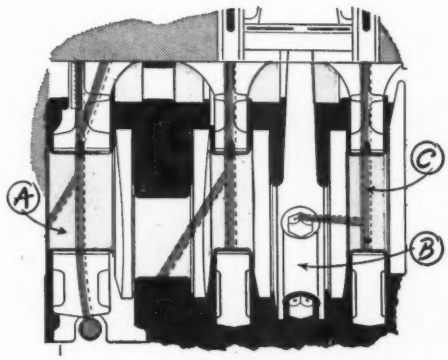
C. Contains detergent which keeps rings clean and operating freely...prevents scratching and gouging of liners.

RPM DELO Diesel Oil will not corrode any bearing.

CASE D119F—PROLONGING THE LIVES OF BEARINGS IN DIESELS



SECTION OF DIESEL ENGINE CRANK AND CAM

No bearing failures occurred between overhaul periods in Diesel engines used in the toughest service when they were lubricated with RPM DELO Diesel Engine Lubricating Oil.

A. Non-corrosive to all types of bearing metal...inherent ability of base stocks and added compound resist oxidation and formation of acid which is common cause of bearing corrosion.

B. Maintains a tough lubricating film which withstands excessive shocks and pressures.

C. Special detergent compound keeps oil passages clean and open - allows free flow of lubricant to vital points.

Another compound in RPM DELO Oil prevents foaming of the oil. An accurate measurement of crankcase levels can always be obtained.

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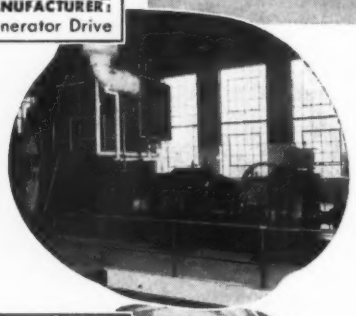
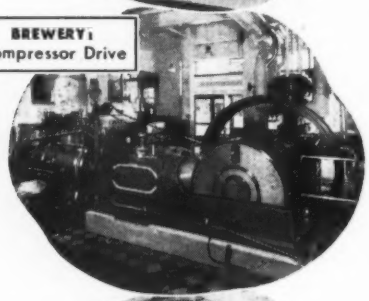
PUMPS, LINESHAFTS

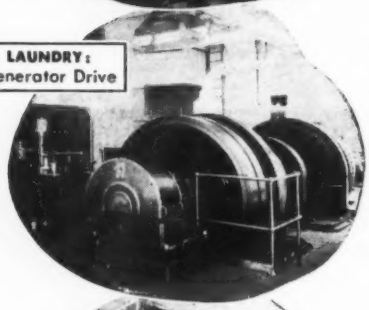
MACHINE TOOL MANUFACTURER: Generator Drive



BREWERY: Compressor Drive



LAUNDRY: Generator Drive



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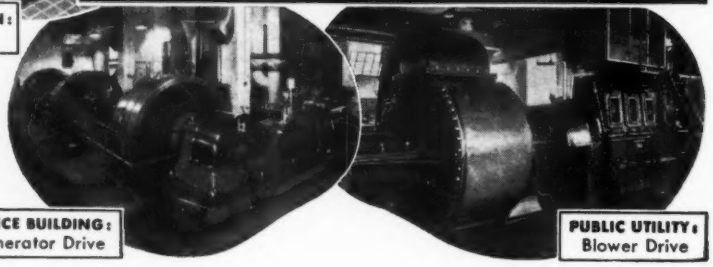
PUBLIC INSTITUTION: Generator Drive



OFFICE BUILDING: Generator Drive

PUBLIC UTILITY: Blower Drive

incorporated in the mechanism become the weakest link

Some companies, where seal problems have been particularly acute, have found that considerable savings can be realized by research programs carried on in addition and supplementary to the work of seal manufacturers. Specific answers to many of the factors previously mentioned have been obtained, as well as a considerable accumulation of comparative life data between various seal designs and methods of manufacture. *AISE Paper.*

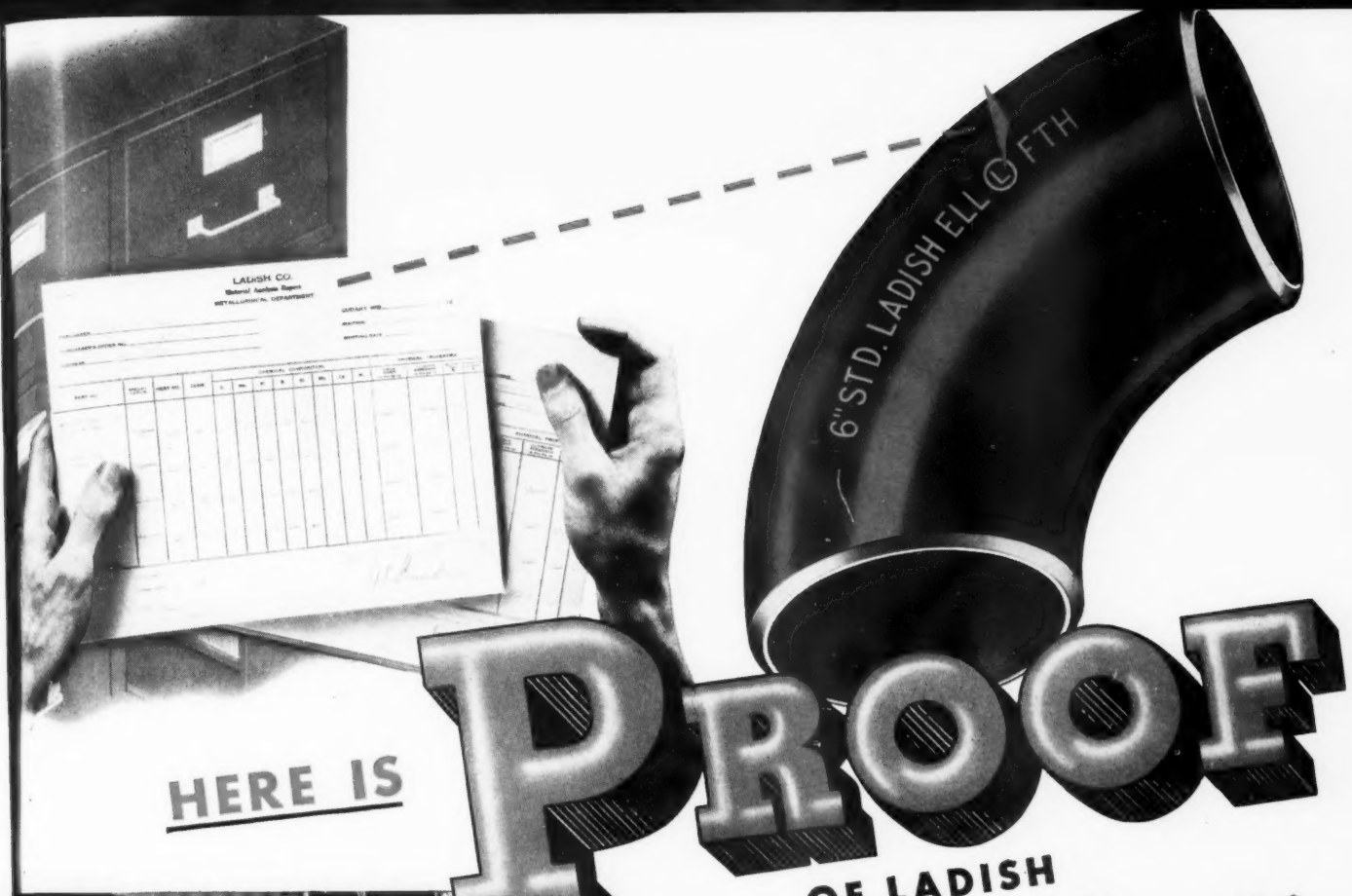
HIGH-TEMPERATURE LUBRICANTS, *by G L Sumner, Westinghouse Electric Corp.* The ever-increasing demand for lubricants capable of withstanding high temperatures is indicated by NEMA classifications of motor insulations. These include Class O, Class A, Class B, and Class H, designed to withstand temperature hot spots of 90, 105, 130 and 180 C respectively. Bearings and lubricants must be found to function at these temperatures.

Discussed are limitations of orthodox greases (mineral-oil dispersions in soaps) and ordinary laboratory tests for evaluating them for use in antifriction bearings operating at high temperatures.

The paper describes a method for evaluating greases used on ball bearings, individually housed, and ambiently heated, that may be run at variable conditions of speed and temperature. *AISE Paper.*

Philip Sporn, president of American Gas and Electric Co and its subsidiary, Indiana and Michigan Electric Co, in presence of officials of the two companies and a number of invited guests, broke ground Sept 1 as the initial step in construction of a new power plant to be located near Lawrenceburg, Ind.

Georgia Power Co will absorb into its power system the energy output of the Army Engineer's 74,000-kw hydro plant at Allatoona Dam. In return, the government may take from Georgia's system a maximum of 2,500,000 kwhr per week for its own power customers. These are the salient features of the 10-year contract signed recently by Georgia Power officials and Interior Secretary Krug. Under the 1944 flood control act, Interior is responsible for sale of all power produced at dams built by the Engineers. Allatoona, located on Etowah River near Cartersville, Ga., is the first of a series of major dams being erected in the southeast by the Army. Disposal of its output conceivably could set a pattern for contracts covering the 204,000-kw Buggs Island development on the Roanoke River and the 280,000-kw Clark Hill project on the Savannah.



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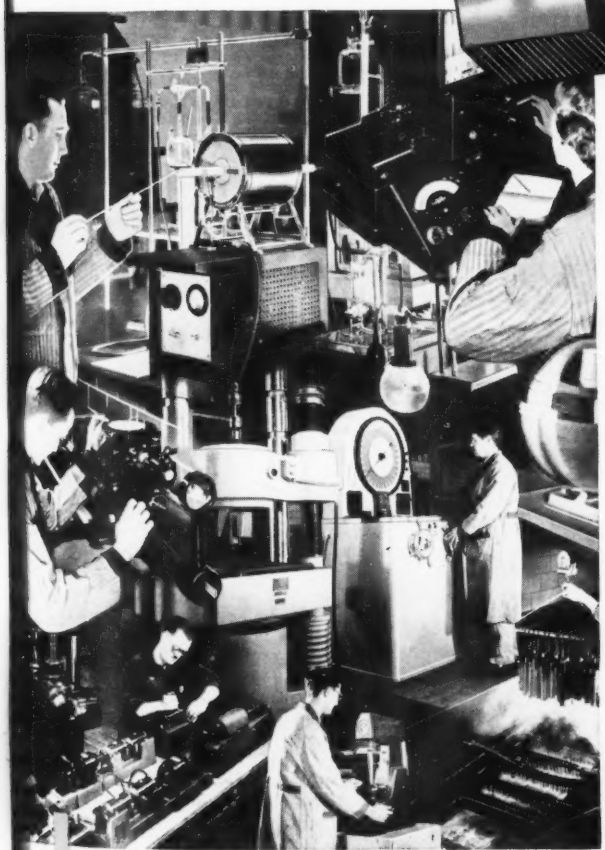

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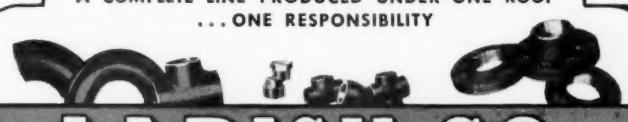

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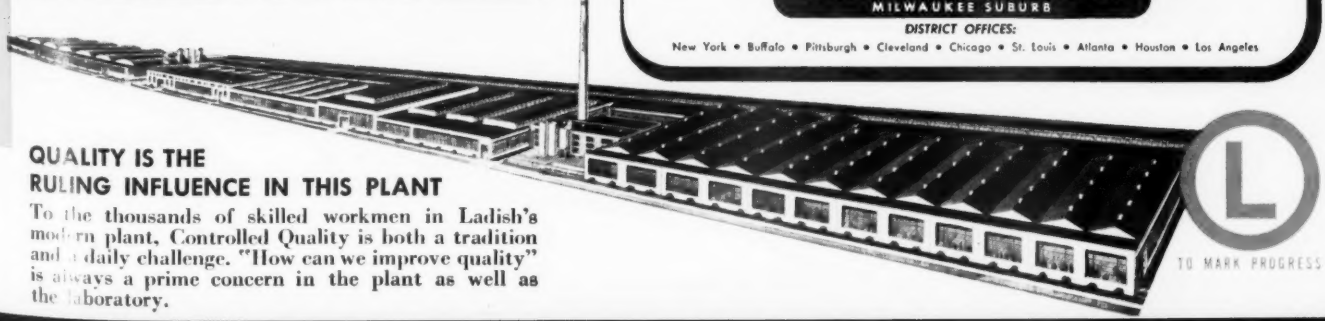

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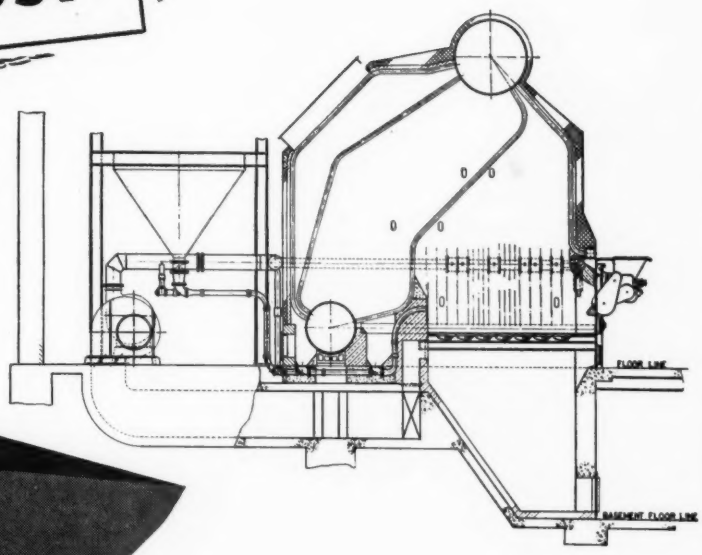

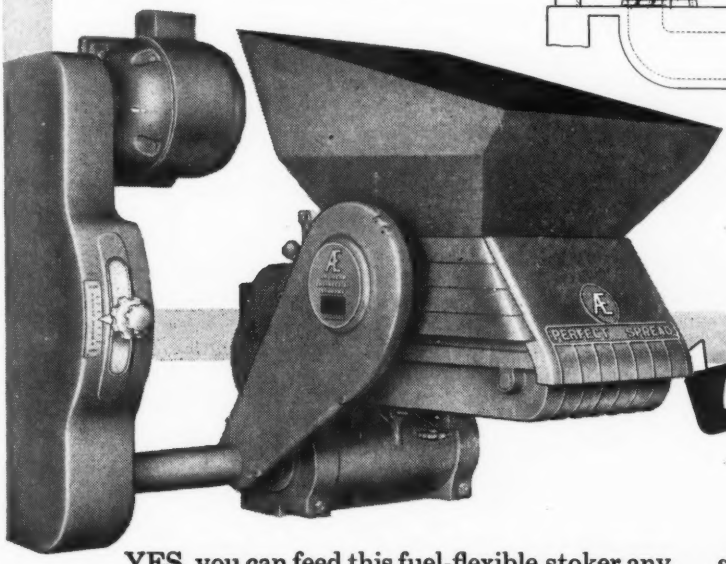

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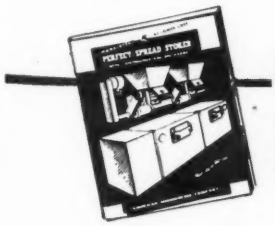

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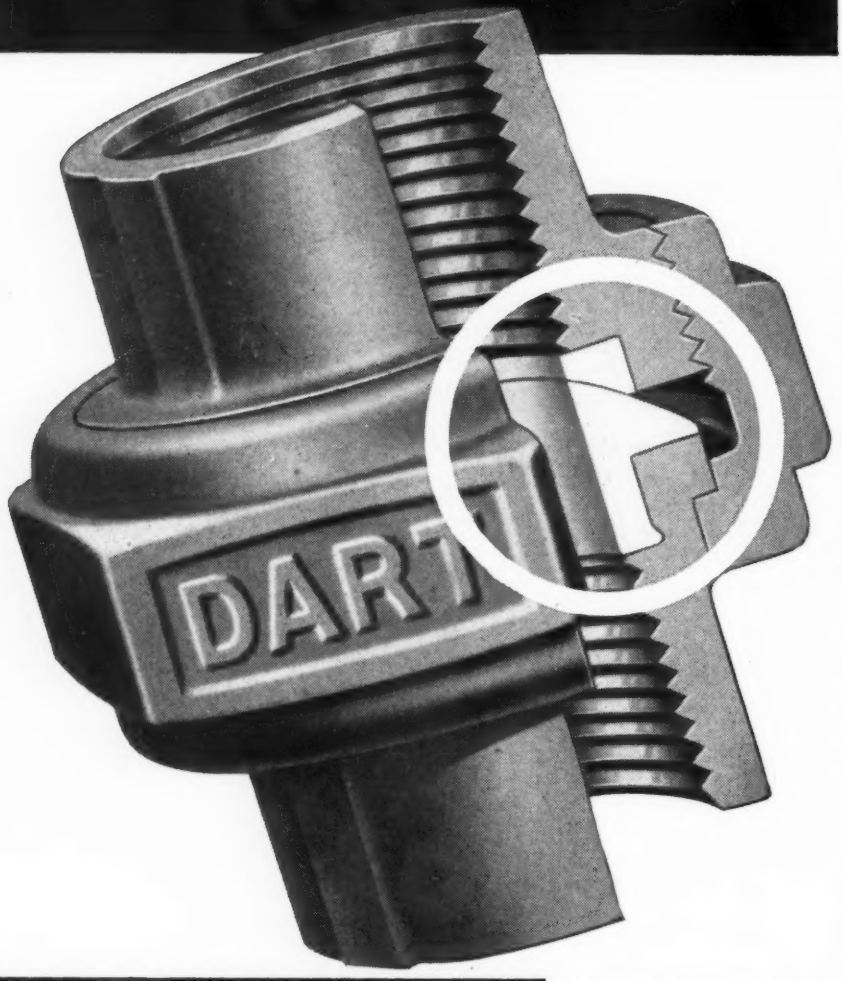

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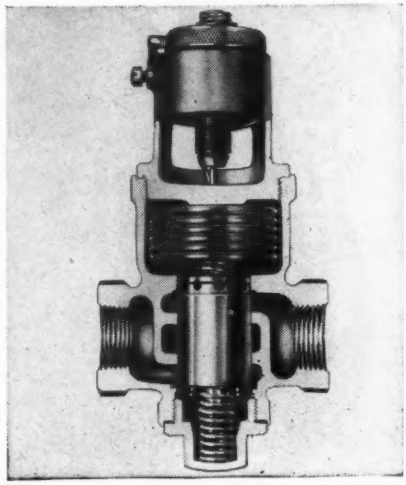
New Equipment

(*Continued from page* 134)

that is fastened to motor and pumpshaft. Pumpshaft is assured positive lubrication by oilite bearing in which it rotates. Power is supplied by a 1/6-hp single-phase 60-cycle 110-v motor. This 2-position pump is available with either 1¼- or 1½-in. pipe. Close fit of balanced die-cast impeller to bored diameter of body results in high hydraulic efficiency. **Marsh Heating Equipment Div, James P Marsh Corp, Skokie, Ill.**



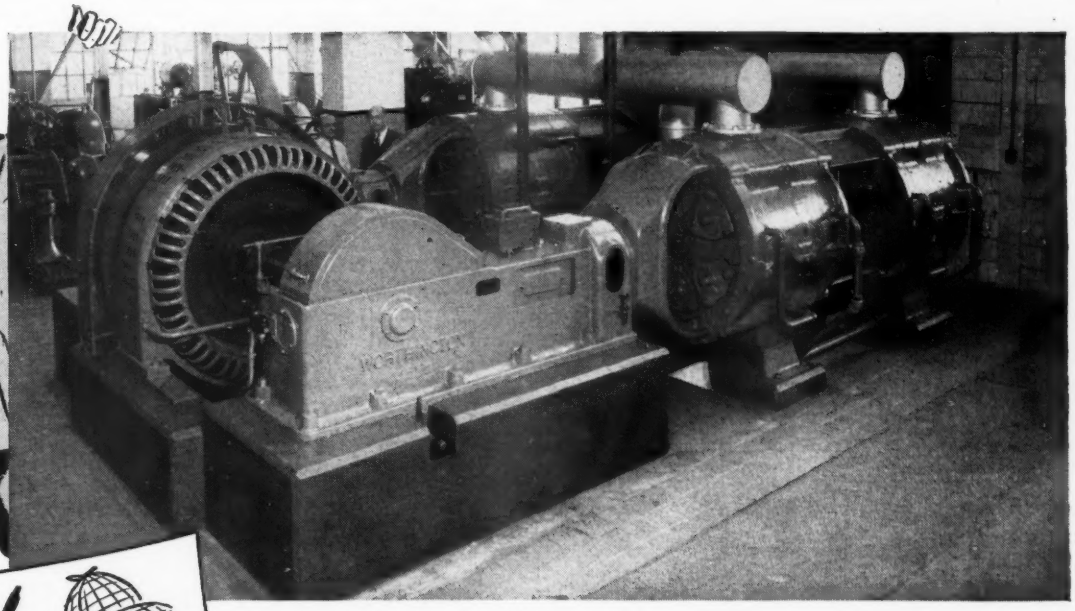
Temperature Control E414

TEMPERING CONTROLLER maintains constant predetermined water temperature at its outlet, regardless of heater temperature variation. It also automatically compensates for normal pressure fluctuations. The valve may be set for any desired discharge temperature between 100 and 170 F. Setting is made on a dial calibrated in 10-deg units with a 5-deg space between. Valves are available in ¾ and 1-in. sizes. Approximate capacity of the ¾-in. size is 20 gpm at 50 psi, and the 1-in. size can deliver about 35 gpm at 50 psi. Control is suitable for buildings, institutions and other places where scalding water is necessary at some outlets, but undesirable, wasteful or dangerous at others. **Symmons Engrg Co, Boston, Mass.**

Electrodes E433

WIDE RANGE of arc-welding operations can be met with four new electrodes. Type *W*-60, a low hydrogen coating electrode, manganese-molybdenum analysis, has good usability characteristics, and serves most hardenable steels free from the hazards of underbead cracking. Type *W*-61, a low-hydrogen electrode of molybdenum-vanadium composition, serves either ac or reverse polarity dc to weld a variety of low-alloy steels. *Type W*-62, low-hydrogen, titania-coated electrode of 2½% nickel composition, produces weld deposits with high-

NOW...it's a long time between inspections!



Worthington 32 x 16 Twin Tandem Horizontal Duplex Dry Vacuum Pump at Buffalo Electrochemical Co., Inc.

Worthington triples the running time of previous installation

After searching investigation, this Worthington Dry Vacuum Pump was selected to replace highly recommended imported pumps which alone were thought capable of handling highly oxidizing and corrosive gases.

One deciding factor was the famous Worthington Feather* Valve — the lightest, tightest, quietest ever made. After an initial 10-week run, it was found that this and the many other advanced Worthington features had turned in a performance exceeding that of the imported pumps. Since then, the Worthington Pump has operated on regular 10-week periods between inspections and cleaning — *as compared with previous 3-week periods!*

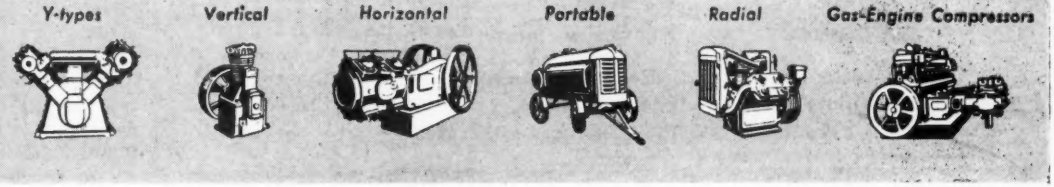
GET THE DETAILS

All through industry, Worthington Horizontal Dry Vacuum Pumps are leaving records of better-than-expected performance . . . piling up proof that *there's more worth in Worthington.* Bulletin L-710-B1B gives you the reasons why. Write to *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.* *Reg. U. S. Pat. Off.

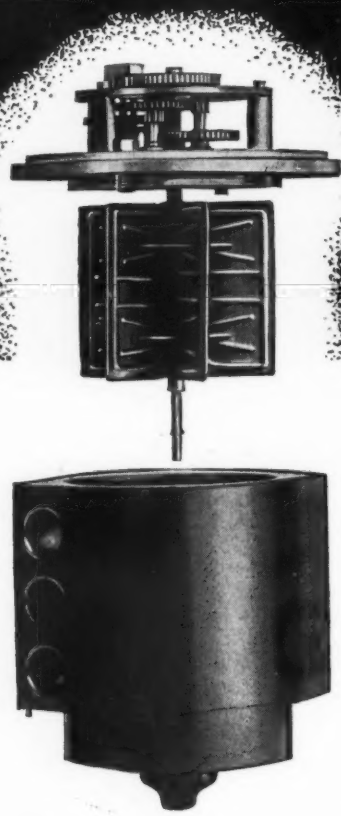
WORTHINGTON

K8-6

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON



BUILT TO TAKE PUNISHMENT



HENSZEY *Feed Water* METERS

Notice the simplified, rugged construction of the inside mechanism of the Henszey Meter. The rotor (directly connected to the gear train) fits into the measuring chamber without close clearances. Bearing surfaces, shafts and bushings subject to friction and hard wear are made of tough, long-wearing Stellite. Calibrations of the straight-reading horizontal register can be made to read in gallons, pounds, or cubic feet at any specified temperature.

Yes, that's why Henszey Meters are used for dependable, accurate measurement of boiler feed water, boiler blowdown, condensate, chemicals and other similar liquids. Send for bulletin.

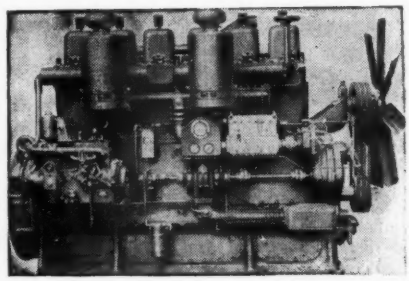
HENSZEY CO. Dept. D11, Watertown, Wis.

HENSZEY

FEED WATER METERS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Flow Indicators • Boiler Feed Regulators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

impact properties at sub-zero temperatures. *Type W*-95 gives a hard wear-resisting weld metal in all positions, using ac or dc. **General Electric Co, Schenectady 5, N. Y.**

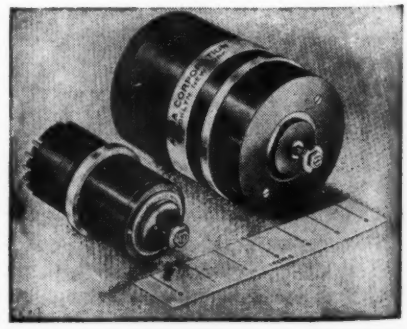


Diesel Engine E472

MODEL 6-LRD DIESEL is rated 300 hp at 900 rpm, stripped, or as a complete radiator-cooled power unit at 281 hp and 900 rpm. Maximum output of stripped engine is given as 330 hp at 1050 rpm and of the power unit, 301 hp at 1050 rpm. Cylinder dimensions are 8½ x 8½ in., which with 6 cylinders gives a displacement of 2894 cu in.

This engine has a 7-bearing graphitic-steel crankshaft, heat-treated and hardened. Cylinder block is a one-piece casting with wet-type cylinder liners inserted. Pistons are cast iron with four nonsticking wedge-type rings and two straight-side oil control rings. Piston is cooled by intermittent circulation of oil under pressure from the lube-oil system; at the bottom of each stroke underside of crown is scoured by fast-moving oil.

Waukesha combustion chamber is used on this unit. As a power unit it is equipped with waste-packed oil filters, fuel filters, built-in governor, American-Bosch injection system and, when so desired, can be equipped with an individual gasoline-engine mechanical starting system. Flywheels and housings ranging from SAE 00 to 1 are available, as well as clutches, slide rails, safety shutdown and other accessory devices. **Waukesha Motor Co, Waukesha, Wis.**



Electrical Computer E445

DESIGNED SPECIFICALLY for electromechanical computing and control equipment, this electrical *Resolver* offers an accurate and dependable means to solve problems involving trigonometric functions. The device is designed to deliver two alternating voltages proportional, respectively, to $e_1 \sin A$ plus $e_2 \cos A$, and $e_1 \cos A$ plus $e_2 \sin A$ where

TERRY

GENEROUS BLADE CLEARANCES IN THIS 900° TERRY WHEEL TURBINE INCREASE DEPENDABILITY . . . .

The 290 H. P. Terry Turbine shown above is used for Boiler Feed Pump Drive in a recently completed central station. It operates with steam at 850 lbs.-900° F. and employs a Terry one piece wheel, as illustrated at the left.

The blades of this Turbine have large radial and axial clearances. They are further protected by projecting rims at the sides of the wheel. These rims would take without damage any rubbing that might occur if the radial clearance became reduced. It is therefore impossible for the blades to foul.

The side clearance is very large - one inch - so that end play can do no damage.

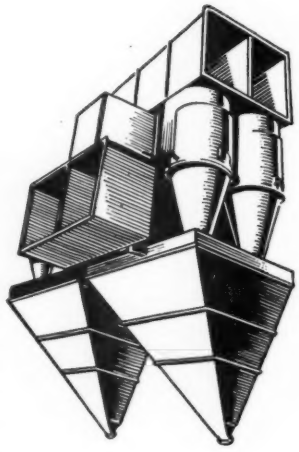
Such construction makes for dependable operation.
- Descriptive bulletins sent on request. Ask for S-116.

T-1167

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

PRACTICAL fly-ash PREVENTION

can be a reality



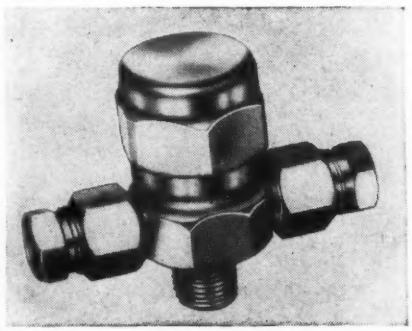
. . . if you logically consider the problem. Too few dollars can easily buy disappointing efficiency while it is just as possible to over-invest with the same result. That's where the Buell van Tongeren Cyclone comes in. With a patented "Shave-Off" to overcome the "double eddy" evil, it can be big enough to overcome plugging hazards. Individually engineered for each specific application Buell is in a class apart in achieving high fractional efficiencies. There's convincing data in the 1948 Buell catalog. Write to: BUELL ENGINEERING COMPANY, 10 Cedar Street, New York 5, N. Y.

• See our exhibit at the 18th National Exposition of Power and Mechanical Engineering Grand Central Palace, New York Nov. 29 to Dec. 4, BOOTH No. 72

buell

Engineered Efficiency in DUST COLLECTION

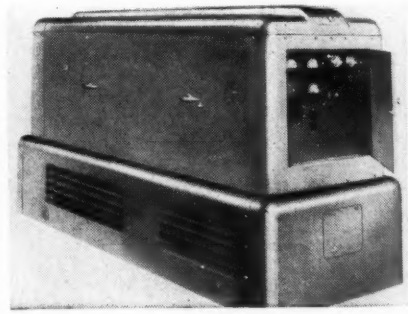
e_1 and e_2 are voltages applied to two primaries and A is angle through which rotor has been turned from position defined as electrical zero. **Arma Corp, 254 36th St, Brooklyn 32, N. Y.**



Lubricator Valve E475

KNOWN AS THE GRANNAN LUBRICATOR, this device dispenses all lubricants from light oils to heavy greases through the same valve without change. The through-flow valve has no pockets or crevices to retard lubrication flow. Valve is completely inclosed to prevent leakage and to eliminate possibility of contamination of lubricants from outside sources.

Lubricator is installed directly into bearing and does not require special guns to introduce lubricant into the system. Lubricator functions either with hand-operated guns or from a completely automatic set to operate at any desired interval. Suitable for use with road machinery, mining equipment, machine tools and other production machinery, this lubricator handles up to 500 bearings or more in less than one minute, while machine is in operation. **Titeflex, Inc, 595 Frelinghuysen Ave, Newark 5, N. J.**



Diesel-Electric Plants E470

MODEL 205DSP 2500-watt diesel-electric plant is powered by an air-cooled single-cylinder 4-cycle engine. Automatic compression release makes possible electric starting. Plant has inherently regulated generator that provides good voltage regulation without use of rheostats or other external equipment. All engine and generator controls are conveniently located on the steel base. Available in 60-cycle ac models for 115 or 230 v, single-phase; or 115/230 v, single-phase 3-wire; or 230 v, 3-phase 3-wire. Standard equipment includes two heavy-duty 6-v starting batteries in series, oil filter, oil-bath air

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" BRASS CO. *Headquarters for BRASS, BRONZE, and COPPER*

Condenser Tube Problems at Consolidated Edison

How do the large power plants solve their many condenser tube problems? Engineers of Consolidated Edison, New York, kindly consented to be interviewed by the Copper Alloy Bulletin and supplied some interesting facts.

Water Conditions Poorer

Continued increased pollution from sewage and industrial wastes has made the waters in New York harbor more and more corrosive to condenser tubes. Consolidated Edison has, for a number of years, made a practice of trying out new alloys and changing to better, more corrosion-resisting ones as they are developed by the brass industry.

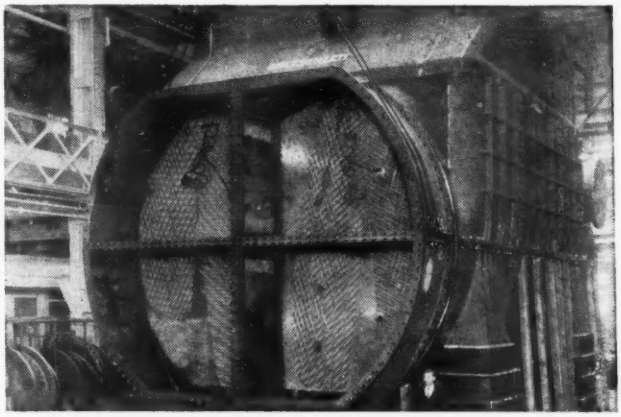
About twenty-five years ago, Admiralty was the best available alloy and Consolidated Edison standardized on it.

When Aluminum Brass was developed in England about eighteen years ago, Consolidated Edison tried it out and found it to be superior to Admiralty in resisting inlet end impingement corrosion. A few years later this alloy was supplied by domestic brass mills. For most of the Consolidated Edison plants Aluminum Brass has replaced Admiralty and lasts considerably longer.

Development of Aluminum Bronze

As early as 1913 Consolidated Edison was interested in trying out Aluminum Bronze (95% Copper, 5% Aluminum). An experimental installation of about 5000 tubes was made at that time in their Sherman Creek plant then operated by United Electric Light and Power Company. These tubes were removed in 1933 *—a period of 20 years,* although their useful life had not been exhausted. Compare this record with Admiralty which was used in adjacent condensers of identical design and averaged six years before retubing.

Another test lot of Aluminum Bronze was installed by Consolidated Edison at Hudson Ave. in 1932 and service tests proved its superiority over aluminum brass. At the present time, Aluminum Bronze is out of the testing stage and is now a preferred alloy.



101,000 square foot Worthington surface condenser Unit No 7. Capacity 160,000 G.P.M. and 1,590,000 lbs. per hr. condensate.

Although the merits of Aluminum Bronze had been known for many years, only experimental quantities had been produced because of the difficulties encountered in manufacture. However, through special casting techniques and the use of new and more powerful mill equipment, Bridgeport introduced Duronze IV*, (Arsenical Aluminum Bronze) in 1938 as a standard alloy.

Advantages of Service Tests

Consolidated has learned that the most practical way of finding out whether a certain alloy is satisfactory is to install a number of tubes in certain places in the condenser which give the most trouble. Careful records are kept of their service life under actual operating conditions. Naturally it costs money to maintain such tests but they more than pay for themselves in valuable knowledge acquired. It is not necessary to make a large investment in tubing to try out a new alloy since only a limited number will suffice. Consolidated Edison has also tested other alloys. Red Brass (85% Copper, 15% Zinc) gave an unsatisfactory performance, as it stood up for only about six months. Cupro Nickel (70% Copper, 30% Nickel), which gives an outstanding performance for fast ocean-going ships, was not entirely satisfactory under existing polluted harbor water conditions.

The High Cost of Maintenance

With greatly increased labor costs, every effort is made to keep maintenance down to a minimum. Experience has shown, first of all, that it is most economical to use the best alloys available regardless of the higher initial costs, which are soon absorbed through longer service life, fewer shut-downs, less frequent re-tubing, etc. However a certain amount of cleaning is absolutely necessary.

Today's units, with modern high pressure boilers and improved turbines, are much more efficient than the older designs. Consequently the tendency is to operate the newer units on a continuous basis. The older ones are used for peak loads and as standbys and generally operate for about ten hours a day, being idle the rest of the time.

Since uninterrupted service of the most modern units leads to greatest economy, every effort is made to keep them in operation. About once a day chlorine compounds are introduced in the circulating water for a short period to prevent or remove slime deposits which interfere with heat transfer. When it is necessary to shut down these units for maintenance the condenser is cleaned manually.

Consolidated Edison has found from long experience that keeping the condenser tubes as clean as possible prolongs their service life. However, they still have the problem of impingement corrosion which takes place at the inlet ends of the tubes. It is true that Aluminum Bronze withstands this attack better than the other alloys. However, protection can be obtained by painting the inlet ends of the tubes and the tube sheet with a special paint. Unfortunately, this method is time consuming since the paint has to be applied very carefully and evenly. It also has to be dried for a number of hours before using. Since shut-down time is very expensive, other methods of reducing inlet end corrosion are also being tried such as inserts which are secured in the tubes.

Conditions Vary

Experience of a successful power company such as Consolidated Edison can be helpful to other power plants interested in efficient and economical operation. Bridgeport recognizes that each power plant has its own problems as to water conditions and operation of the turbines and condensers. An alloy which proves successful in one location may be unsatisfactory in another. For this reason Bridgeport will be glad to cooperate with engineers by suggesting alloys to be tried out and by discussing the results of tests made under actual operating conditions.

Bridgeport's Corrosion Laboratory carries on a consistent program of corrosion research with the objective of understanding the properties of available alloys, improving existing alloys and developing new and better ones. Much information on the properties of available condenser tube alloys is given in Bridgeport's Condenser Tube Manual. Contact the nearest Bridgeport District for condenser tube service.

**U. S. Patent No. 2093380*

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • *ESTABLISHED 1865*

Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal

When you need specific information on materials or equipment, reach for your Sweet's File for Power Plants (the big red file). It contains 119 manufacturers' catalogs full of useful information on thousands of products...from absorbers—gas, to zeolite. Cross indexing speeds finding.

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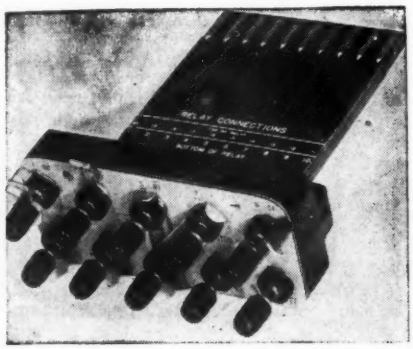
cleaner, muffler, two flexible fuel lines, hand crank and one extra fuel-injection pump, holder and nozzle. Battery cables, hydrometer and remote start-stop station are also included.

Watercooled plants, in 10- and 35-kw sizes, are powered by Buda diesels. They are enclosed in weatherproof sheet-steel housings with removable side panels (*see photo*). Welded base is of heavy structural steel. A welded-steel battery and accessories rack contains two 6-v starting batteries; a 12-v belt driven generator keeps all batteries fully charged. Generators are inherently regulated.

Other features include circuit breaker, low-oil-pressure cutoff and over-temperature cutoff switch. Both engine and electrical instrument panels are built in and illuminated by pilot light. All ac models have a running-time meter.

Watercooled models are available for 60-cycle ac, single and 3-phase, all standard voltages. Also available are 50-cycle ac models and dc models in 10- and 15-kw capacities. **D W Onan & Sons, Inc, 43 Royalston No, Minneapolis, Minn.**



Drawout Relay Test Plug E451

DESIGNED TO MAKE RELAY TESTING easier and quicker, this new plug, made of sturdy plastic molding, may also be used with meters. All terminals are mounted on vertical front of plugs. Each terminal is clearly marked, eliminating necessity for counting studs or relay connections.

A complete set of hardware, including shorting bars and clips for test leads, are supplied with each plug. **General Electric Co, Schenectady 5, N. Y.**

Wound-Rotor Motor E476

AVAILABLE IN RATING of 1 to 15 hp, this wound-rotor *Life-Line* induction motor has open dripproof construction. Frame is rolled from steel plate and the feet are pressed steel. Pulley end bracket is pressed steel while front end bracket is close-grained gray cast iron.

Rotor core consists of punchings riveted into a solid structure and held on the shaft by a shrink fit. Rotor windings have coils threaded into partially inclosed slots. The self-sealed, pre-lubricated ball bearings have a special lubricant sealed in at the factory. Under normal conditions further lubrication will not be necessary for five years or longer. Type *CWP* wound-rotor motors may be used wherever adjustable speed is required, or where high starting

CONTROL

Scale and Corrosion in Power Plant Equipment

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Newly Perfected

Water Conditioning Chemicals

Recently developed applications of the newer colloids and surface-active agents in Wright Chemicals for power plants result in improved water conditioning—positive scale and corrosion control. Wright Chemicals contain 100% soluble, available chemicals—no waste or inert matter—insuring increased operating efficiency and reduced cost.

Boiler Water . . .

Corrosion and scale-forming compounds in boiler water can be controlled with Wright Chemicals.

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Steam and condensate lines can be properly protected by using Wright recommended formulas.

Cooling Jackets . . .

Efficiency of cooling jackets can be substantially increased by preventing corrosion and scale deposits on heat transfer surfaces.

Wright improved chemicals are the result of intensive study and research by men with years of experience in the development, production, application and control of water-conditioning chemicals.

Wright has no one cure-all to solve all problems. Each receives individual treatment. The Wright field engineer, who will call on you upon request, will obtain all necessary information and samples for examination in the modern Wright laboratory. Analyses are interpreted in view of supplemental information received, and recommendations made in the form of a proposal. Clients are provided with regular laboratory service as a periodic check upon conditions.

There is a Wright Field Engineer near you, anxious to help solve your scale and corrosion problems. No obligation.

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Specializing in Water Conditioning

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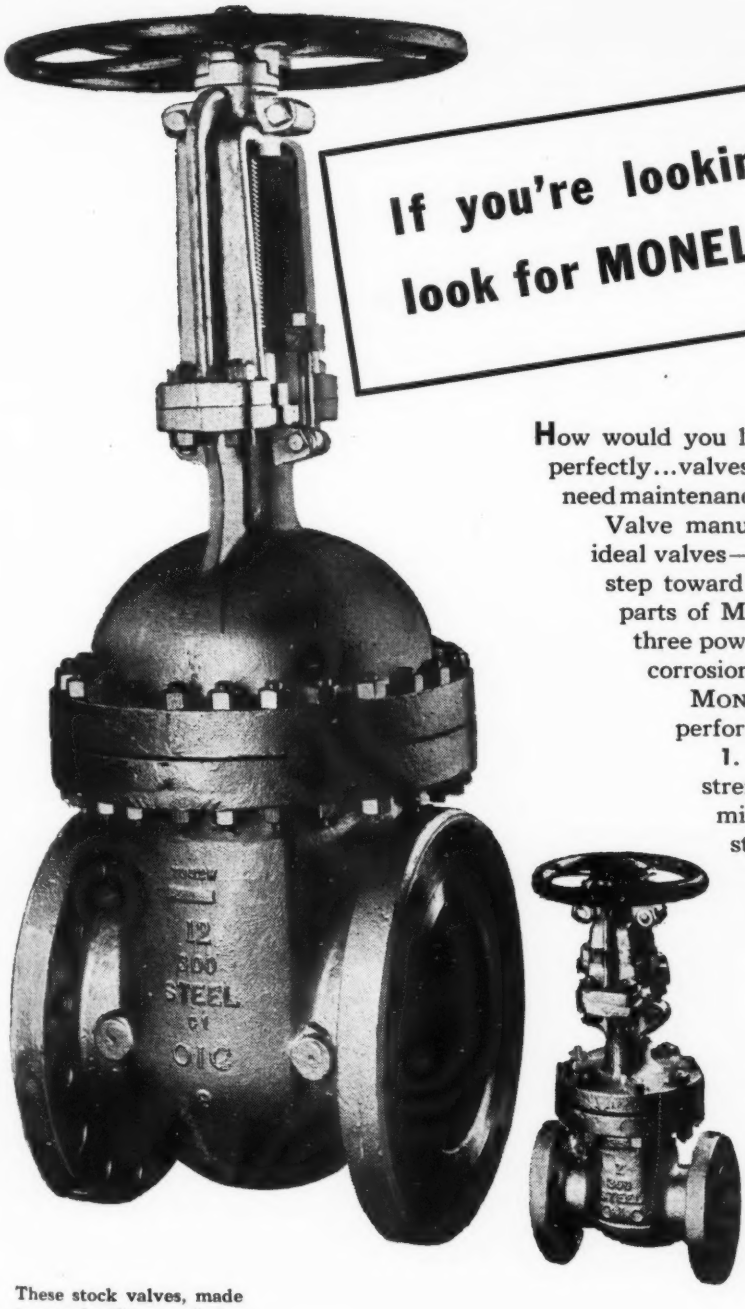
If you're looking for extra service, look for MONEL in the valves you buy



How would you like valves in your plant that will always work perfectly...valves that will never wear out...valves that will never need maintenance attention? You'd probably describe them as ideal!

Valve manufacturers haven't succeeded in producing these ideal valves—*yet*. But many leading makers have taken a long step toward the ideal by making valve bodies and working parts of MONEL*. For MONEL is one metal that fights the three powerfully destructive enemies of all valves—erosion, corrosion, and abrasion.

MONEL valves and valve parts can give you improved performance in 4 important ways:

1. Fewer mechanical failures. MONEL's exceptional strength, which exceeds that of structural steel, can minimize failures caused by overstressing seats, stems, and other working parts.

2. Less erosion and abrasion wear. Because of its superior hardness, MONEL can substantially reduce damage caused by turbulence, flow erosion, and particle abrasion. With heat-treatable "K"* and "KR"* MONEL, a degree of hardness can be obtained that greatly exceeds that of other non-ferrous alloys. This feature, alone, can sometimes extend valve life by a large percentage.

3. Fewer corrosion worries. Being rust-proof and corrosion resistant, even at high temperatures, MONEL can greatly extend the service life of valves operated under severely corrosive conditions. With fewer replacements and repairs required, valve maintenance costs can be kept to a minimum.

4. Fewer failures caused by heat. MONEL has good heat-resistant qualities, and is satisfactory for service up to 800° F. MONEL is oxidation resistant, and does not embrittle even under continuous high-temperature conditions.

It is because of this remarkable combination of properties that MONEL has been chosen by so many leading valve makers as an industrial "task" metal. You'll find MONEL in many types of fine valves . . . valves designed to give you *extra* service with *minimum* maintenance.

If you would like more information about MONEL as a valve material, write to Bob Johnson, in care of the International Nickel Company. He will be glad to supply you with engineering data and dependable sources of supply. *Reg. U. S. Pat. Off.

These stock valves, made to serve in all types of pipe lines, are standard with seats of hard, corrosion-resistant cast "S"*MONEL, to insure longer service life with minimum maintenance. Made by Ohio Injector Company, Wadsworth, Ohio.

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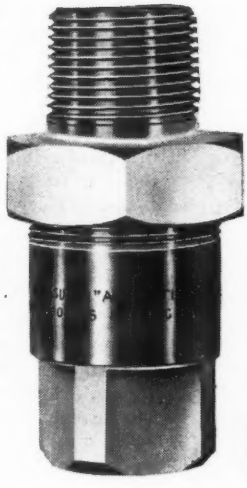

George Automatic Steam Drain Valves are designed for locomotive and steam plant service. The body of this valve is heat-treated "KR" MONEL, operating-spring is cold-drawn MONEL, and the conical closure disk is Type 303 18-8 Stainless Steel. Made by George Manufacturing Company, Phila., Pa.

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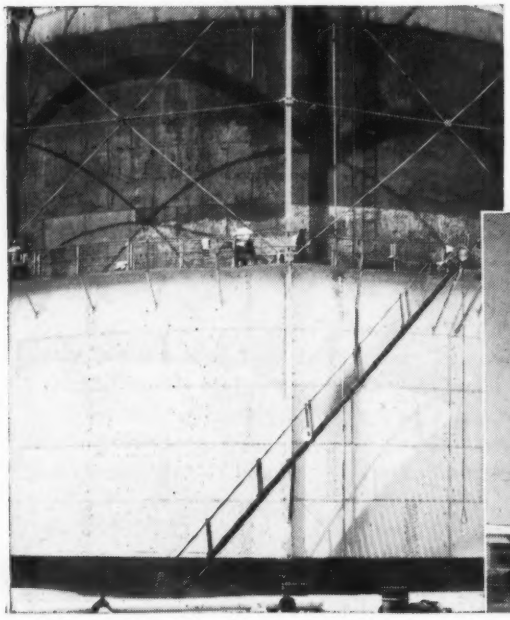
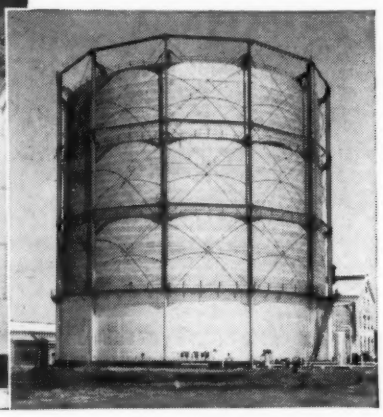
MONEL...*for minimum maintenance*

Don't Let Rust and Corrosion Eat Away YOUR PROFITS!



Dum Dum for Metal being applied to the Gas Holder of the Pacific Gas and Electric Company.



The same Gas Holder completely finished with Dum Dum for Metal and protected for many years to come.

Dum Dum for metal gives long-lasting protection to METAL SURFACES

Dum Dum for Metal now offers the same long-term protection to metal surfaces that its famed companion product, Dum Dum Masonoc, has been giving for years to all types of masonry structures. More than a paint, Dum Dum for Metal is thick, tough, elastic . . . designed specifically to protect metal surfaces against the hazards of weather-wear, industrial fumes and gases. Stops those deadly enemies of metal structures . . . rust and corrosion.

When you cover your vital metal structures with this attractive aluminum colored coating, you give added lustre to your plant, but best of all you cut maintenance costs . . . stop profit leaks. Write today for your copy of this important booklet describing Dum Dum for Metal.

MAIL COUPON TODAY

THE ARCO COMPANY, Dept. P11
7301 BESSEMER AVENUE, CLEVELAND 4, OHIO

☐ Please send booklet describing Stack Dum Dum and Dum Dum Masonoc.
☐ Please send booklet describing advantages of Dum Dum for Metal.
☐ Please have sales representative call.

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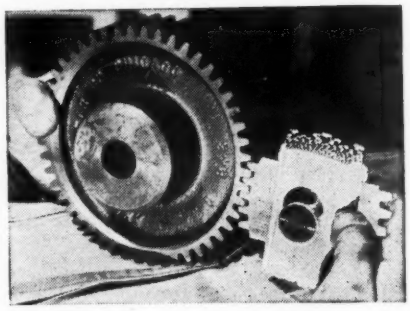
torque with low starting current is necessary.

The motors are available for 60, 50 and 25 cycle, two and three phase, 208, 220, 440 and 550 v; 1750, 1160, 870, 690, 580 rpm for 60 cycle; 1450, 965, 715, 580, 485 for 50 cycle. Similarly for 25 cycle, speeds are 1450, 750, 485. **Westinghouse Electric Corp, 306 Fourth Ave, Pittsburgh 30, Pa.**



Gear Gage E444

THIS GEAR GAGE, with 20-deg pressure angle, is used to make a quick check of gear pitch. Device, of stainless steel, checks full-length tooth forms 3-4-5-6-8-10-12-16-20-24-32-48, and stub tooth forms $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{7}$, $\frac{6}{8}$, $\frac{8}{10}$, $\frac{10}{12}$, $\frac{12}{14}$, $\frac{16}{21}$, $\frac{20}{26}$, $\frac{24}{32}$, $\frac{32}{42}$, $\frac{48}{64}$.

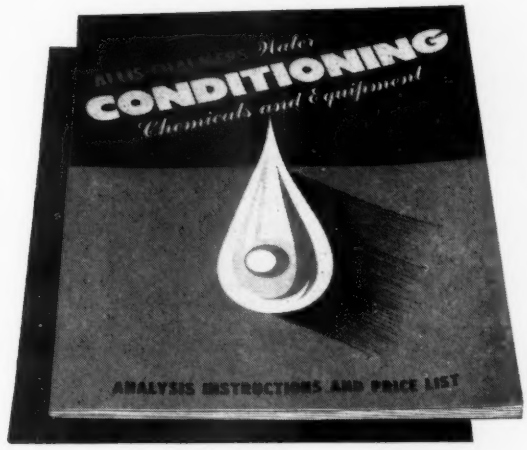
The device eliminates tedious calculation and computation to determine pitch of gear. By merely rolling gage over gear teeth, one can tell the pitch instantly without chance of error. **Geo Scherr Co, Inc, 200 Lafayette St, New York, N. Y.**

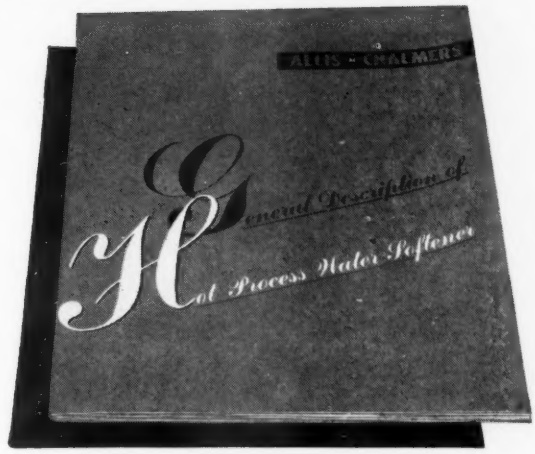
Starting Switch E453

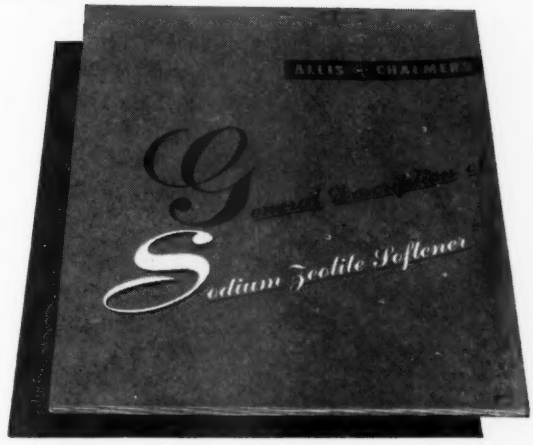
DESIGNED FOR service with fractional-hp motors driving blowers, pumps, ventilating systems, small machine tools, and a wide variety of similar applications, this switch comes in five types.

The five types include those with and without a general-purpose enclosure; combination unit and selector switch; with cast-iron enclosure for wet locations and a similar type for dusty or hazardous locations. A feature of all the types is the molded base of moisture-resisting insulating material that mounts and encloses the mechanisms and contacts. This construction serves not only to protect against dust, but to direct heat concentration to bimetallic tripping devices, assuring quick and

Water Conditioning Problems?







THESE BULLETINS MAY HELP YOU BETTER UNDERSTAND THEM!

YOUR DAY AT THE PLANT is full enough without having to spend time and effort solving your own water conditioning problems. Why not let *specialists* do this work for you?

Allis-Chalmers' background in treating both high and low pressure plants can aid you in the selection of the *correct* process and *right* equipment for your plant. Long experience of A-C engineers in all types of water treatment is your assurance of dependable service.

A-C water conditioning service includes:

1. **Corrective Chemicals**—for external and internal boiler water treatment . . . designed for silica removal and control of scale, corrosion and carryover. Specially prepared scale and corrosion inhibitors for all heat exchange cycles . . . dependable reagent chemicals.

2. **Equipment**—Hot and Cold Process Softeners . . . Sodium and Hydrogen Zeolite Softeners . . . Degasifiers . . . Deionizers . . . Chemical Proportioning and Feeding Equipment . . . Chemical, Booster and Filter Backwash Pumps . . . Oil Removal and Water Filters.

3. **Comprehensive Consultant Services**—surveys, reports . . . complete chemical and X-ray analytical service . . . special studies.

Descriptive A-C literature offers valuable information. Call your nearest A-C Sales Office.

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MILWAUKEE, WIS.

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- ☐ 6611 Description of Hot Process Water Softeners
- ☐ 7107 Sodium Zeolite Softeners

Name.....

Company.....

Title.....

City.....State.....

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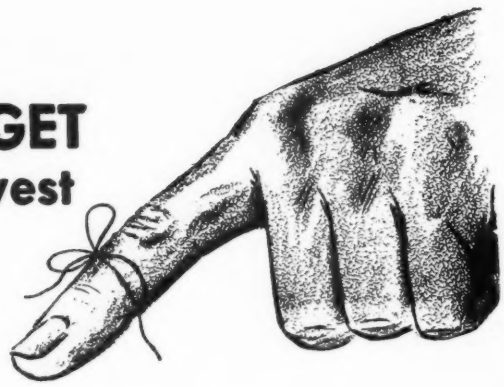
to see the newest ways of cutting costs— at the...



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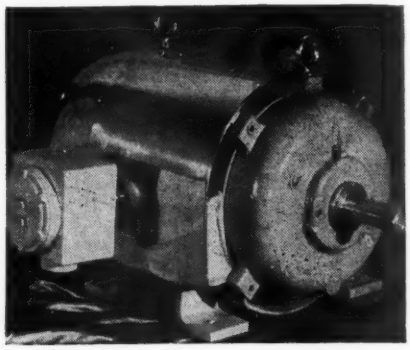
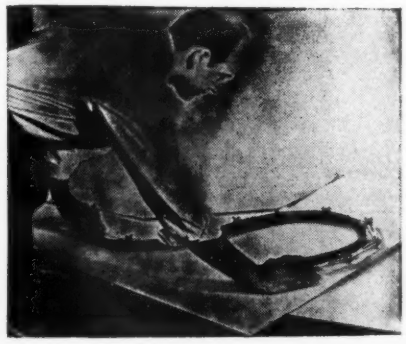
positive action on overload. Switch handle moves to *off* position on overload, giving positive indication that power is shut off. **General Electric Co, Schenectady 5, N. Y.**



Chemical Motor E474

CORROSION-RESISTANT MOTOR for chemical industries is offered in frame sizes 203 through 326. Built to Underwriters Laboratories' standards for operation in Class 1-Group D (highly inflammable and explosive vapors) the new motor has also been made explosionproof. By suitable attachments and connections, the motor will meet specifications of Bureau of Mines.

Monel is used for outer cover, fan cover and lead outlet. Fan and several other exposed parts are brass or bronze. **Reliance Electric & Engrg Co, Cleveland, Ohio.**



Flexible Template E427

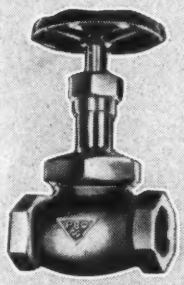
RUGGED SPRING STEEL and aluminum construction characterize a flexible template that can be set and locked in any desired shape, contour, curve or radius, according to its manufacturer. Once released, the device springs back to its original position ready for reuse. **C H Clark and W E Poggenburg, 4900 Wynnefield Ave, Phila, Pa.**

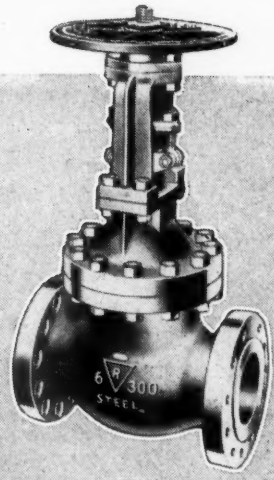
Transformer Load Relay E477

OPERATED by a bimetal mounted within a well in the transformer, Type *TRO* relay continually evaluates hottest-spot temperature of the copper winding, permitting safe loading of power transformers to their full thermal capacity.

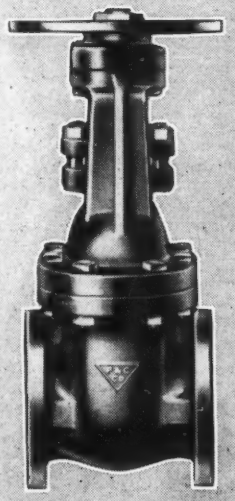
This switch operates in three stages: The first is actuated by increased transformer load to start cooling fan. If load

"VALVE MEN" LIKE R-P&C VALVES

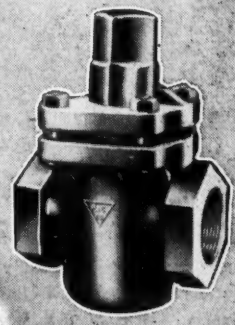




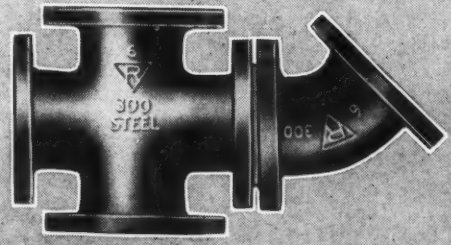
Men who really know valves—
know where to look for those details of design and construction that insure top performance—have a lot of respect for Reading-Pratt & Cady.



***An R-P & C valve** must be more than just an assembly of machined parts. It has work to do. R-P & C feels the responsibility for that work being done faithfully.*



***Consider your R-P & C distributor** as your "valve man"—a responsible source for bronze, iron and steel gate, globe, angle and check valves—Bar Stock valves—iron cocks—Lubrotite gate valves—cast steel fittings.*



ACCO Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit • Houston
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READING-PRATT & CADY DIVISION
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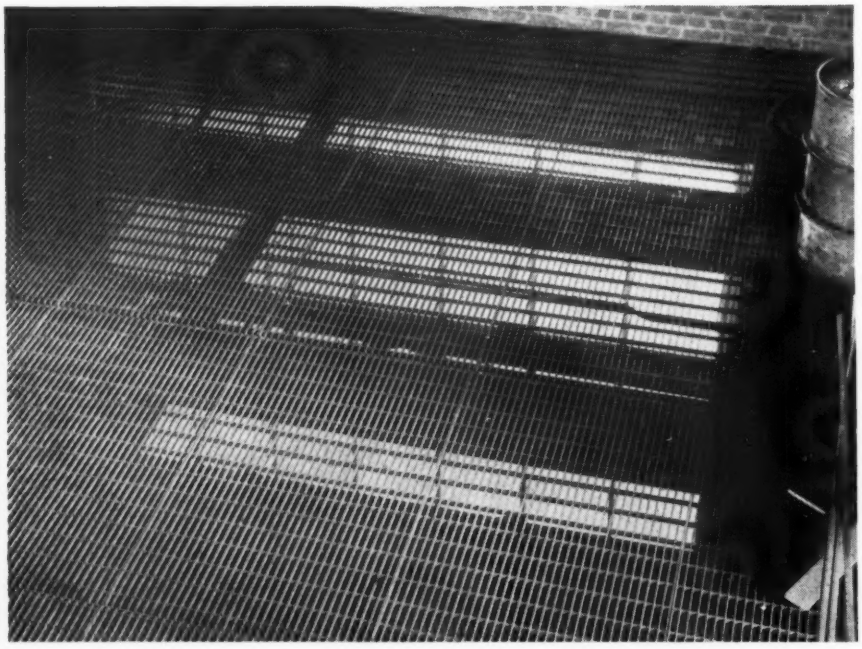
TRADE MARK

READING-PRATT & CADY

Where light and air are essential

specify Hendrick Mitco Open Steel Flooring



The illustration shows an installation where the 90% open area of Hendrick Open Steel Flooring permits the passage of ample light and air through three floors.

In hundreds of factories and power plants, in city subways, on shipboard, hundreds of thousands of square feet of this flooring have given long years of satisfactory service because of outstanding Hendrick Mitco advantages.

Of pressure-formed integral construction, there are no bolts, rivets or angle irons to loosen or weaken, or to form projections to catch dirt and obstruct passage of light.

The square-edge, uniformly spaced steel bars provide a level, non-slipping walking surface. Because every Mitco panel is a strong, integral unit, there is no lateral deflection of the flooring, however heavy the load.

HENDRICK SHUR-SITE TREADS for stairs, ladders and fire escapes, have the level walking surface of Hendrick Open Steel Flooring and other Mitco advantages. A heavy, flanged nosing-bar that makes the edge of each tread clearly visible is a valuable safety feature and also gives reinforcement where the load is greatest.

HENDRICK ARMORGRIDS are unequalled for floors, loading platforms, ramps and driveways that have to withstand heavy traffic.

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Manufacturing Company

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

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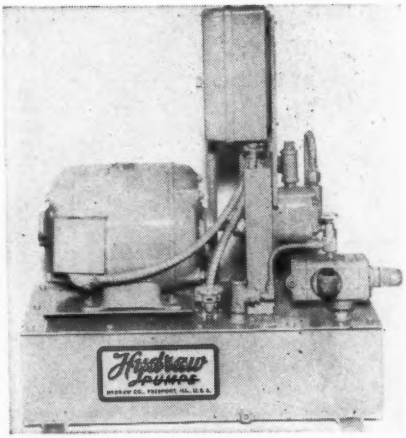
Sales Offices In Principal Cities

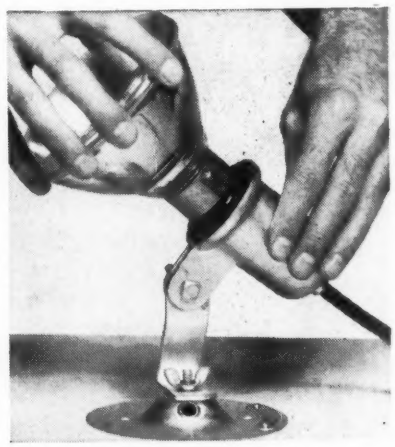
increases and approaches safe thermal operating limit, the second switch closes sounding an alarm. If load continues to increase, the third switch either trips circuit breaker or gives second alarm.

Action of transformer relay depends upon temperature of the top oil, load carried by transformer, and length of time load has been carried. This relay protects against overload, but will not function on short circuits unless their protective relays fail to operate. A single relay protects a 3-phase transformer where loads are reasonably well balanced. **Westinghouse Electric Corp, 306 Fourth Ave, Pittsburgh 30, Pa.**



Hydraulic Power Unit E462

FLEXIPOWR UNIT consists of an all-steel and welded oil reservoir in 5-, 10-, 20-, 30- and 50-gal capacities, motor, starter box, hydraulic pump, relief valve, and strainer. Pump capacities range from ½- to 50-gpm and 1000-psi working pressure. Units have an automatic oil-level control that stops operation in the event of low oil level or loss of oil in reservoir. *Flexipowr* units are suitable for installation in remote and hard-to-service locations. **Hydraw Co, 116 N Galena Ave, Freeport, Ill.**



Adjustable Lamp Holder E442

LAMP HOLDER consists of a steel base and stand attached by a wingnut clamp to a die-cast zinc socket housing. Base fits standard 3¼- and 4-in. outlet boxes. Socket is sealed against moisture and dirt by a

Better Coal Preparation for Greater Combustion Efficiency

WITH

AMERICAN SHREDDER RING CRUSHERS

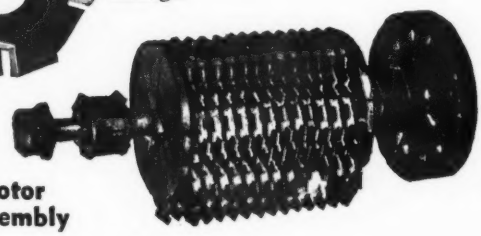
= RAGGED FIRE BED
= EXCESSIVE CO_2
= ASH PIT LOSS

= EVEN FIRE BED
= UNIFORM COMBUSTION

Every pound of coal means *more* BTU's—more efficient heat, when Americans do the preparation job! ROM coal is reduced rapidly with exacting control of fines, uniform sizing and no oversize—at a cost of less than 1¢ a ton. The result: Americans pave the way for a loose, uniform firebed quickly responsive to sudden steam demands—without excessive ashpit drop or unnecessary CO_2.

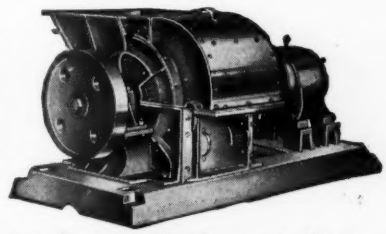
Shredder Ring

Patented manganese steel shredder rings, exclusive with American Rolling Ring Crushers, *split the coal* by impact rather than by crushing. Shown below is the rotor assembly, with its many rows of shredder rings. Each ring has twenty cutting edges — and revolves on individual shaft, free to deflect from tramp iron without damage.



Rotor Assembly

American Type "S" Rolling Ring Crusher, with heavy cast steel housing and sectional construction, secured at dust-tight machined joints with coupling bolts for easy access to crushing chamber.



Write for details on efficiency of coal preparation in power plants with American Crushers.

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

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Made by a packing manufacturer who knows the needs of packing users. This fast, convenient tool will save you time, money and material over the slow laborious sloppy method of cutting gaskets by hand. Gasket cutting is put on a production basis by the "ALLPAX". Cuts clean gaskets in any gasket material in diameters from 1" to 36", with any width flange. Pays for itself and effects savings every time it's used.

FREE TRIAL OFFER

For a limited time only, we will ship an ALLPAX Gasket Cutter for a 30-day trial at our expense. Write for details of this offer.

Complete . . . ready for use . . . packed in hardwood case with hinged cover. Equipment includes six (6) double-edge cutting blades and one (1) 18" varnished wood cutting board. Order NOW.

PRICE COMPLETE $19.50

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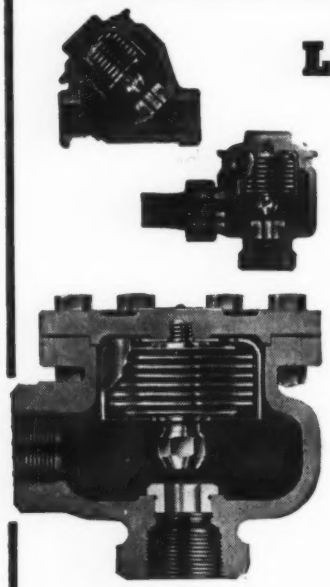
MAMARONECK, N. Y.

We Invite You TO TEST NICHOLSON STEAM TRAPS FOR

LOWEST STEAM LOSS

LARGEST CAPACITY



See why an increasing number of America's leading plants are standardizing on Nicholson traps. Test trap gladly sent.

Comparative tests by large trap users show: record low for steam waste; 2 to 6 times average drainage capacity; operate on lowest temperature differential; no freeze-ups; greater simplicity (fewer spare parts to stock). 5 types for every purpose; size ¼" to 2"; pressure to 225 lbs.

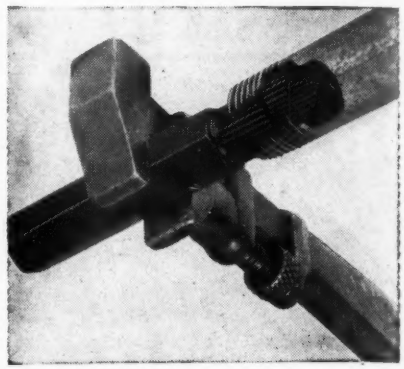
Control Valves for All Mediums

For steam, water, air, gas, oil; and for all types of operation—lever, foot, solenoid, motor. Choice of 6 metal combinations to meet specific needs. Pressures to 5000 lbs. CATALOG 546.

BULLETIN 1047
or see Sweet's

W. H. NICHOLSON & CO.
125 OREGON STREET, WILKES-BARRE, PA.

treated-asbestos gasket. Equipped with a twin-conductor, weatherproof cord, the unit is suitable for general floodlighting. **General Electric Co, Schenectady 5, N. Y.**

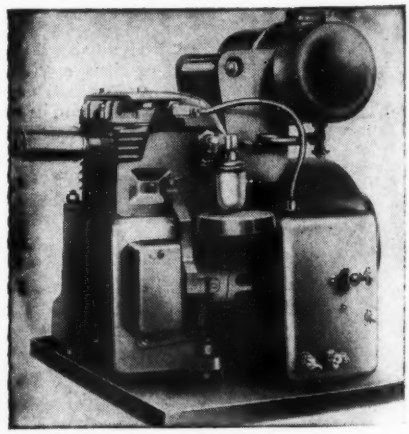


Pipe Wrench E410

INTERNAL PIPE WRENCH comes in three standard pipe sizes, ½, ¾ and 1 in. Wrench can be used to insert as well as loosen pipe or remove nipples broken flush with the inside of a pipe. **Roddick Tool Co, Costa Mesa, Calif.**

Diesel Lube Oil E469

EXHAUSTIVE FIELD TESTS of *RPM Delo Supercharged* lubricating oil for diesel engines show, maker claims, that new product is successful in extending period between overhauls that have been undesirably short in areas where high sulphur fuels are used and under extremely severe operating conditions. Caterpillar Tractor Co has designated this oil as a "Superior Lubricant" and presented a certificate to that effect to the maker. **Standard Oil Co of Calif, 225 Bush St, San Francisco, Calif.**



Portable Lighting Plant E438

POWERED by a 4-cycle, air-cooled engine, the Model *AAE* generates 350 watts ac and is small enough to fit easily into automobile trunk compartment. This new series is available in 115-v ac models, as well as 6-, 12- and 32-v dc battery-charging types. All models have electric push-switch starting.

Designed to start from a storage battery, Model 03*AAE* is provided with a 6-v wind-

(*Continued on page* 164)

REFRIGERATION OR DEVASTATION*

the choice may be Yours!

What would happen in your plant, should excessive over-pressure go unrelieved? Explosion? Fire? Wrecked Machinery? Injured Personnel? Death?

Check with your Safety Engineer today to see if lives of your employees and your plant investment are protected against disastrous explosion, with Black, Sivalls & Bryson SAFETY HEADS.

In the 100,000 plants where SAFETY HEADS have been properly installed no pressure vessel equipped with a SAFETY HEAD has ever exploded. For complete information, wire or write the Industrial Power Department, Special Products Division, Black, Sivalls & Bryson, Inc., Power and Light Building, Kansas City 6, Missouri.

*Illustration is an artist's conception of an actual explosion in a refrigerating plant which resulted in equipment damage amounting to thousands of dollars. A BS&B SAFETY HEAD costing only $50.00 would have relieved the overpressure which caused this explosion.

EFFICIENCY RELIABILITY

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Right, Above — CMH Free-Flexing Expansion Joint

Right, Below — CMH Controlled-Flexing Expansion Joint

Wherever expansion joint leakage is a problem (*and it should not be*) CMH FLEXONICALLY* engineered expansion joints offer the maintenance-saving answer. CMH Expansion Joints cannot leak! They are the practical, dependable way to absorb expansion and correct misalignment.

Available in stainless steel or copper and in free-flexing and controlled-flexing types they are suitable for original installations or for replacement of antiquated means of expansion control. Sizes range from 4" to 24" inside diameters, with flanged or welding ends to suit connected piping requirements. Conservatively rated for pressures up to 300 p.s.i., and temperatures to 900°F.

"FLEXON" identifies CMH products, which have served industry for more than 45 years.

*the science of FLEXONICS . . . "the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion" . . . is exemplified in the basic products of Chicago Metal Hose Corporation.

CMH engineered applications are your best assurance of getting the right expansion joint for the job. Write for additional information and ask for a copy of Expansion Joint Bulletin, EJ-47.

CMH EXPANSION JOINTS

CHICAGO METAL HOSE CORPORATION

Expansion Joint Division • Maywood, Illinois

Plants at Maywood, Elgin and Rock Falls, Illinois

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Performance Proved in Hundreds of Locomotive, Marine and Industrial Installations

Specifications:

Steam Pressures . . . to 650 PSI
Steam Temperatures . . . to 850 F.
Back Pressures . . . to 60 PSI
Pump Capacities . . . to 500 GPM
Discharge Pressures . . . to 750 PSI (Heads to 1800)
Liquid Temperatures . . . to 300 F.

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Coffin Turbo Pumps have been in service for a period of more than twenty years. They have demonstrated their outstanding performance in terms of low steam consumption, low maintenance, high efficiency and all 'round trustworthiness.

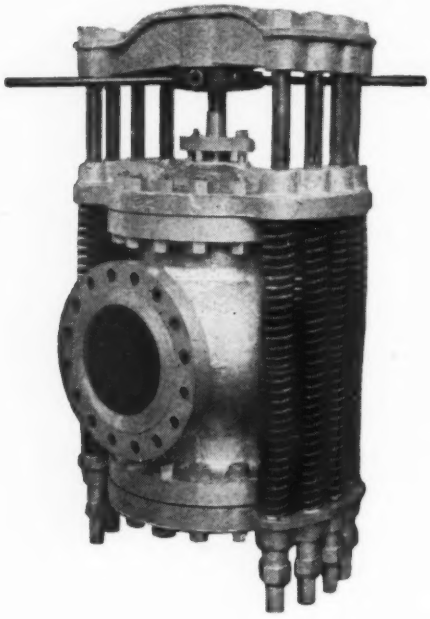
Parts are small, accessible and easily replaced. All wearing surfaces are completely renewable. All parts are 100% interchangeable because they are made to precision limit gauge tolerances. Coffin Turbo Pumps are in daily service under conditions which demand utmost dependability. They are performance-proved.

Ask Coffin engineers for a specific proposal based on your operating requirements. Illustrated literature available on request.

INDUSTRIAL RAILROAD COFFIN MARINE PRODUCTS

The J.S. COFFIN, JR., CO. 326 South Dean St. ENGLEWOOD, N.J.

A VALVE THAT WILL INTEREST EVERY POWER ENGINEER

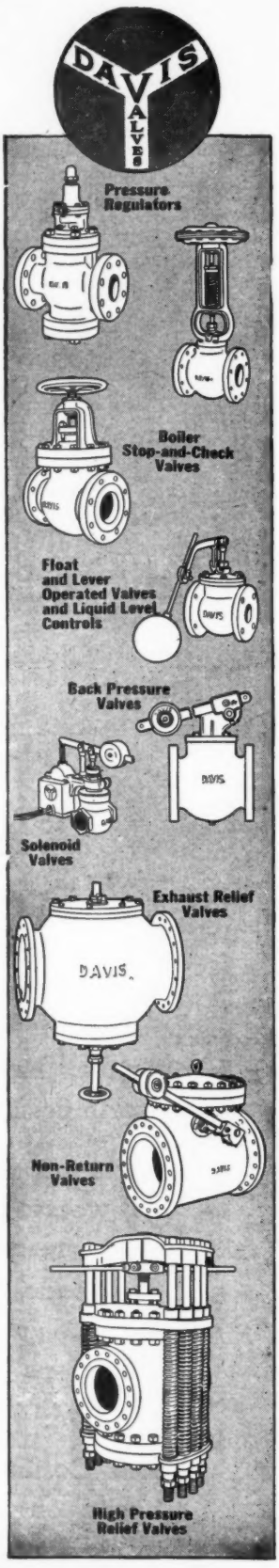


The DAVIS No. 265 HIGH PRESSURE RELIEF VALVE

USES.— (1) For turbine relief on bleeder system. (2) For protection of any boiler room or process equipment by relief to atmosphere. (3) For relief of high pressure lines to low pressure lines at predetermined pressure. (4) For use in plants carrying multiple boiler pressures to protect lower pressure systems.

ADVANTAGES.— Multiple springs result in less spring accumulation . . . less build-up for maximum relief . . . less blowdown to close. Compact design with springs at sides reduces headroom requirements. Center adjusting screw available for quick, easy change of pressure setting.

BUILT TO MEET YOUR REQUIREMENTS. Offered in sizes from 4" to 30" in semi-steel or steel with bronze or stainless steel trim. Test lever and hold-open device available when desired. Detailed information on request.

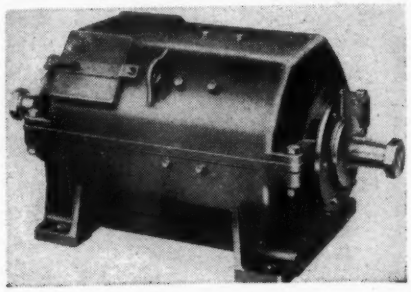


DAVIS REGULATOR CO.

Representatives in All Principal Cities

2540 S. WASHTENAW AVE., CHICAGO 8, ILL.

ing in the generator that charges the starting battery. Unit supplies power for regular lighting, as well as any low wattage ac motor-driven appliances. All models include carrying handle, mounted 2-qt fuel tank, muffler assembly, emergency starting rope, instruction manual and plywood mounting board. **D W Onan & Sons, Inc, Minneapolis 5, Minn.**



Series Mill Motor E455

THIS AISE STANDARD 600 series mill motor is adaptable for use, totally enclosed nonventilated or separately ventilated. It can also be furnished for self-ventilation. Improvements in design include shortened bearing housings and careful proportioning of field poles. Improved commutation is provided by split brushes and four interpoles.

Special grease slingers and grooves keep grease and dust away from commutator and windings. Improved solid cylindrical roller bearings are completely supported against thrust and radial load. **Crocker-Wheeler Electric Mfg Co, Ampere, N. J.**

Phase-Sequence Indicator E452

HAVING NO MOVING PARTS, bearings or pivots, this indicator is applicable to either 120-, 240-, or 440-v circuits at 25, 50 and 60 cycles.

Indicator may be used to predict rotation of polyphase motors as well as determine proper connections for paralleling generators, transformer banks, and power buses. It also determines proper connections for watt-hour meters, reactive and power-factor meters, as well as reverse power and phase-

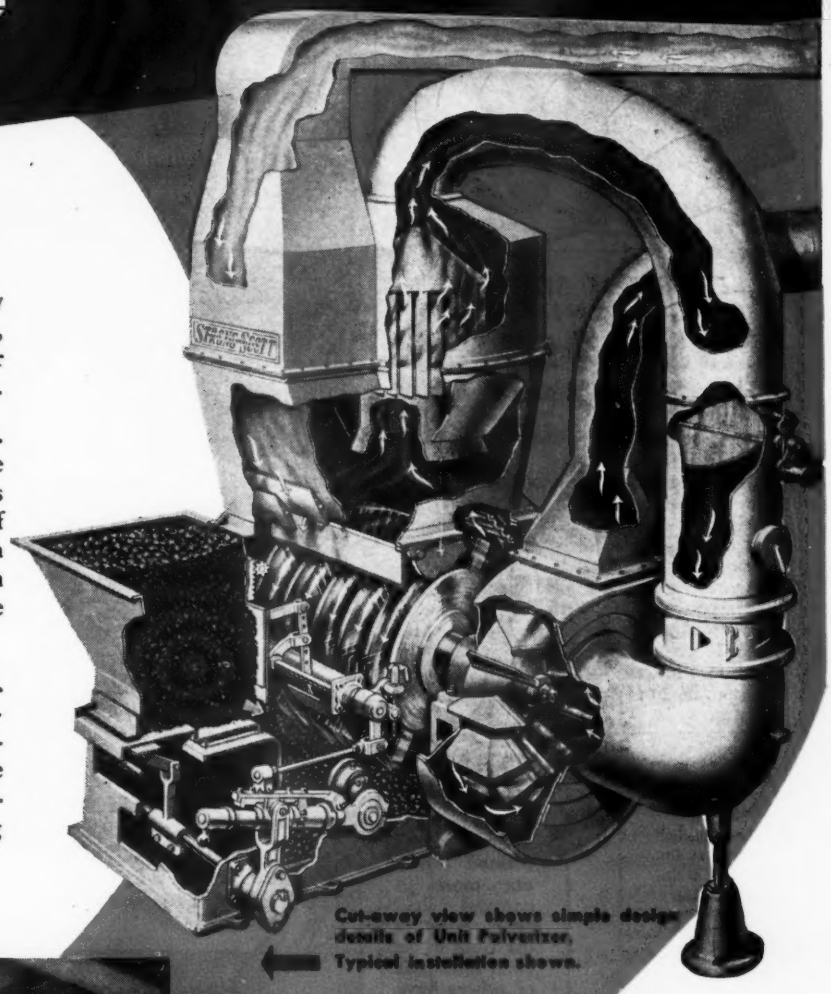
Burns ANY bituminous coal

Check these STRONG-SCOTT UNIT PULVERIZER FEATURES

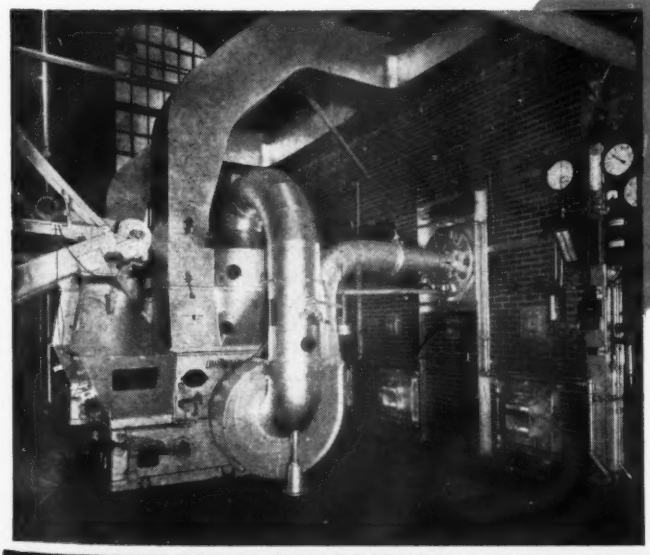
1. FIRES CONTINUOUSLY and uniformly under all conditions, with wet or dry, high or low grade coal, fine or irregular lumps up to 4". Rotor can't clog or jam.

2. REQUIRES MINIMUM MAINTENANCE. Has simple design and rugged, long-life construction . . . . . only one motor runs *entire* unit. All repairs made *outside* of furnace. Pulverizing wear mainly in rotor-blades and fan-blades, of such simple design user may easily provide and install his own replacements.

3. PROVIDES MAXIMUM FLEXIBILITY. Adjustable fuel feed, air supply and fuel-air mixture meets fluctuating steam demands easily. Handles soft coal, lignite or by-product pitch with only simple adjustments. . . . . Adapted to direct-firing boilers, kilns or driers.



Cut-away view shows simple design details of Unit Pulverizer. Typical installation shown.



Backed by 50 years of manufacturing experience—23 in the combustion engineering field—STRONG-SCOTT has a long list of satisfied customers. More than 40% are repeat orders.

With installations in more than 200 American cities, you can easily visit one close by. You'll find our customers our best salesmen.

When you buy a STRONG-SCOTT Unit Pulverizer, you acquire *dependability, service,* and the *assurance* that the company stands behind every guarantee made. Your investment will return reduced steam costs and fuel bills.

WRITE FOR BULLETIN

Send for descriptive Bulletin for complete information. Names of customers in your vicinity furnished on request.

The STRONG-SCOTT Mfg. Co.

455 TAFT STREET N. E. • MINNEAPOLIS 13, MINN., U. S. A.

STRONG-SCOTT UNIT PULVERIZER

LEARN THE SECRET OF BIG EARNINGS IN

COMBUSTION ENGINEERING

There are plenty of big jobs today in Combustion Engineering. Such jobs have always been big pay jobs—and today they are better than ever. High fuel and equipment costs means a greater demand for combustion trained men than ever before.

Do you want such a job? You can have it—if you will train for it. And that is *easy to do.* Just a little of your spare time is required for the simple, easy-reading, practical Hays Home Study Course in Fuel and Combustion Engineering.

A few of our friends whose employees have advanced through Hays training:

- **International Harvester Co.**
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- **Combustion Engineering Co.**
- **Riley Stoker Corp.**
- **Iron Fireman Mfg. Co.**
- **Commonwealth Edison Co.**
- **State of Illinois Cities Service (Oil & Power)**

and many others.

For 28 years we have specialized exclusively in such training. Today, Hays trained men are more in demand than ever. Now is the time to do what hundreds of others have done who hold substantial positions of responsibility today.

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You can't lose by getting the facts. We'll send our book, "Opportunities for the Combustion Expert" without obligation or expense to you. Learn how every lesson is administered by trained practical staff men who give the utmost in help and guidance. Get complete outline of course. Learn how to become a key man in Combustion. Send in the coupon now!

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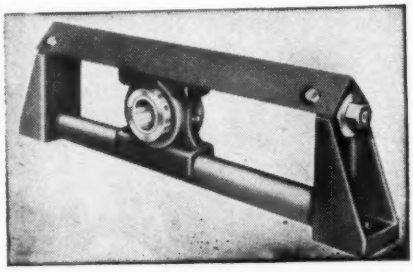
sequence relays. Indicator is housed in a leatherette-covered wooden case with cover to protect two Type *NE*-51 standard neon lamps. It is supplied with three 30-in. leads, having insulated clips to assure quick, easy operation. **General Electric Co, Schenectady 5, N. Y.**

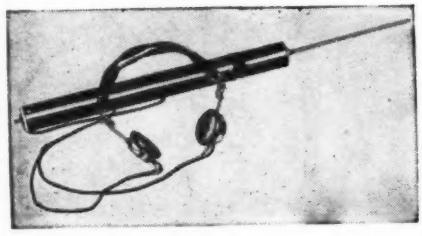


Roller Bearing Take-Up E465

USING THE INNER UNIT of the Type *E* roller-bearing pillow block, this take-up is exceptionally rugged in construction and compact in design. Welded-steel frame provides strength and rigidity without excess weight. Positive adjustment is made by turning screw heads at either head. Top angle member provides effective protection against dust and dirt. **Dodge Mfg Corp, Mishawaka, Ind.**

Soot Remover E432

CHEMICAL SOOT REMOVER in powder form when applied in a boiler furnace under normal operating conditions is claimed by its manufacturer to lower the ignition temperature of coal soot from about 1135 to 775F. *Nalco SR*-150 releases vapors when in contact with the hot fuel bed and these vapors are said to penetrate the soot and bring about ignition at a relatively low temperature. **National Aluminate Corp, 6220 West 66th Place, Chicago 38, Ill.**



Sound Transmitter E421

CEE-TEE SOUNDSCOPE locates trouble in gas engines, electric motors, bearings and other mechanical devices. Unit consists of a microphone, transformer, aluminum probe, and five dry cells. Sound is amplified four hundred times directly into ear phone, enabling the mechanic to detect the slightest noise that indicates trouble. **Como-Tex Co, Board of Trade Bldg, Chicago, Ill.**

Unit Heater E428

A 3-PART CASING, bonderized to make it rustproof, houses this company's Model *H* unit heater. Design is highly functional with top, bottom and sides of one-piece con-

TRAMP IRON

on the "WORLD'S HIGHEST ESCALATOR" takes the "WORLD'S STRONGEST MAGNET"

NEW

DINGS

RECTANGULAR SUSPENDED MAGNET

PROBLEM:

Removing tramp iron from coal on a 42" single belt running from a 656 ft. working level to the top of a 73 ft. tipple . . . delivering 1000 tons of coal per hour . . . WITH THE MAGNET 18" FROM THE BELT . . . as close as it could be placed!

SOLUTION:

Dings solved it by building the *world's strongest* magnet, a triple pole design proved to have 200 GAUSS AT 24" FROM THE SURFACE!

★ ★ ★

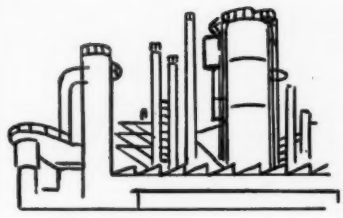
That's the kind of "Magnetic Protectioneering" Dings can give your magnetic requirements. Backed by 50 years experience in meeting . . . and beating . . . magnetic problems for all industries, Dings can help you simplify and economize on many difficult materials handling or iron removal jobs, by the *correct* application of magnetic power. There's a Dings Magnetic Device for every lifting, holding, separating or purifying job. There's a Dings engineer ready to help you solve your problems. Write for details.

DINGS MAGNETIC SEPARATOR CO.

Dings

"HIGH INTENSITY"

Whatever your piping needs

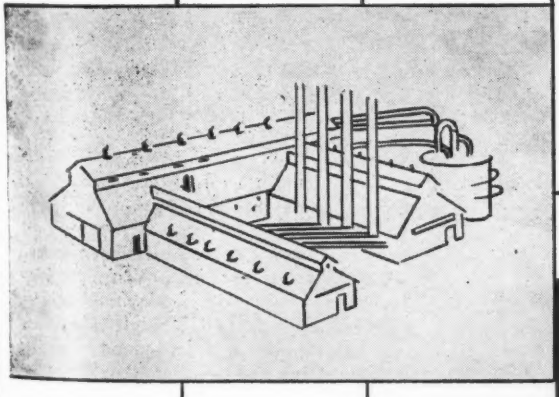


SHAW

fills them quickly, dependably

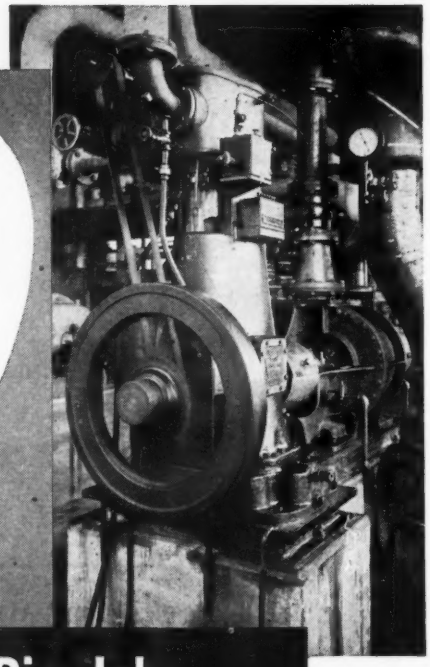
Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping throughout the world.

President



BENJAMIN F. SHAW COMPANY
2100 E. LOMBARD STS. WILMINGTON 99, DELAWARE

KNOWN SINCE 1893 FOR HIGH-QUALITY PIPING PRE-FABRICATION AND INSTALLATION



Your Steam does 2 Big Jobs....

When a Troy-Engberg Engine is Used

With proper plant heat balance your steam may do two big jobs. If you generate steam for processing or heating a Troy-Engberg Steam Engine can produce By-Product Power at a very low cost. The same steam then yields power as well as heat units!

It's the simplest story in the plant. Steam is first passed through the engine — driving pumps, stokers, compressors, blowers or generators. Then the exhaust, with most of the original heat units still intact, is used for processing or heating. And for dependability nothing beats the standard counterflow steam engine . . . no interruptions from power failure.

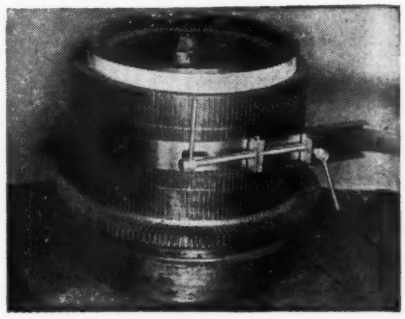
TROY ENGINE & MACHINE COMPANY
(Established 1870)
2500 Railroad Avenue Troy, Pennsylvania

TROY-ENGBERG
STEAM ENGINES • GENERATING SETS • GENERATORS

struction, a fan shroud aerodynamically correct, and grills and louvers spotted in the casing. Heating coil is of floating construction as a protection against expansions and contractions produced by rapid temperature changes. Model *H* comes in 24 sizes, ranging from 20,000 to 352,000 Btu per hr. **Trane Co, La Crosse, Wis.**

Paint-Can Adapter E424

SPECIALLY DESIGNED top and bottom of lightweight cast aluminum makes up a paint-container adapter for spray-painting that clamps over any standard 5-gal paint container by threaded bolts and wingnuts. Unit comes complete with pressure gage, safety valve, regulator valve with all paint outlets built to fit standard spraying equipment. **Silver-Ring Corp, 622 Diversey Parkway, Chicago 14, Ill.**



Armature Clamp E457

THIS CLAMP is suitable for service shops to pull coils into place when rewinding armatures. It also serves to hold commutator segments while assembling and processing. Multipurpose clamps eliminate necessity of using banding machines on armature repair jobs.

Clamp consists of a tough, interchangeable stainless-steel strap furnished in 1½- to 2-in. widths of any desired length; a square swivel assembly and take-up with locking screws of cold-rolled steel. **Marman Products Co, 940 W Florence Ave, Inglewood, Calif.**

Diaphragm Regulator E416

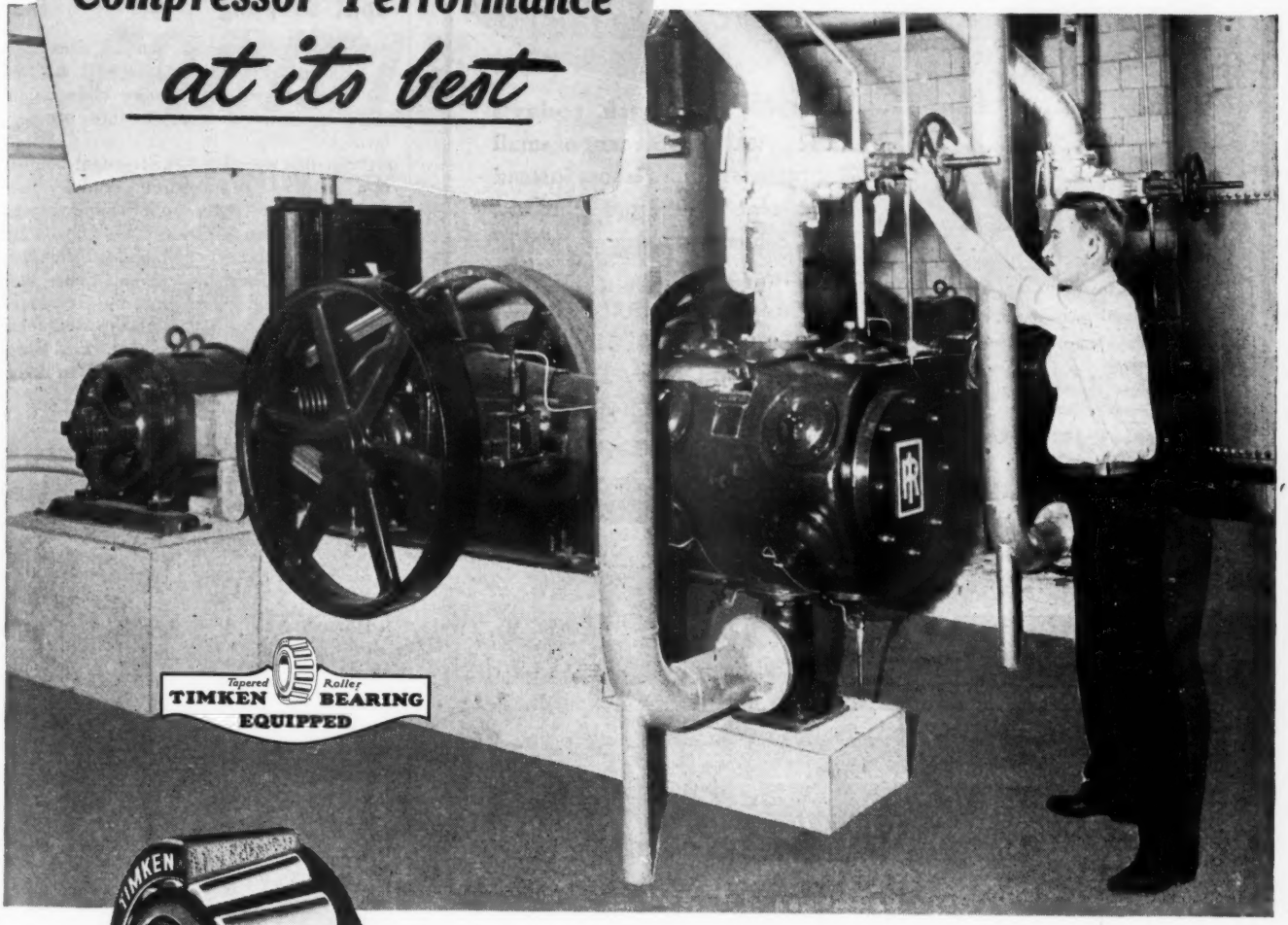
SERIES 18 REGULATORS are designed especially for single-valve control of premix gas-burner systems, and incorporate a soft seat for tight shutoff. Single-valve controls can be used with non-premix systems by connecting the vent on the Series 18 regulator to air line downstream from control valve. Device responds quickly to slight changes in impulse line pressure. Regulator capacity depends upon pressure drop through it and the specific gravity of the gas. Pressure of supply gas should be 2 to 16 oz per sq in. **North American Mfg Co, Cleveland 5, Ohio.**

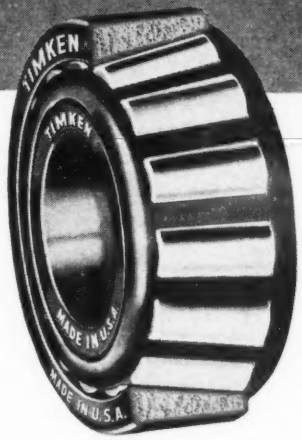
Gas-Electric Blow Torch E417

TORCH IS POWERED by a universal 110-v ac-dc motor and has a capacity of 150,000 Btu per hr. It can be connected to the gas-supply line with ordinary ¾-in. garden

Get Anti-Friction Compressor Performance *at its best*

Ingersoll-Rand 15 x 11 type ES air compressors equipped with Timken Tapered Roller Bearings installed in glass manufacturing plant.





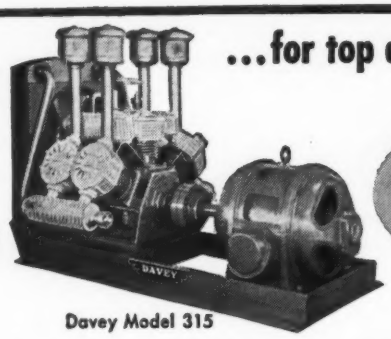
Buy "TIMKEN® BEARING EQUIPPED"

Merely specifying anti-friction bearings is no assurance of getting *all there is* in anti-friction performance; this depends on the *kind* of anti-friction bearings used.

When they are Timken Tapered Roller Bearings you will get incredibly smooth operation; simplified lubrication; radial, thrust and combined load capacity; full protection against wear; positive, permanent crank shaft alignment; and because Timken Bearings are manufactured of Timken Fine Alloy Steel they have greater endurance under all operating stresses. See that you have them in your new equipment. Look for the trade-mark "TIMKEN". The Timken Roller Bearing Company, Canton 6, Ohio. Cable address "TIMROSCO".

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

NOT JUST A BALL ◯ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◯ AND THRUST ◯ LOADS OR ANY COMBINATION ◯



...for top air output *plus* economy

SPECIFY DAVEY DEPARTMENTAL *Compressors*

Davey Model 315

DAVEY DEPARTMENTAL COMPRESSORS GIVE YOU THESE ADVANTAGES

- Power savings
- Lower air losses
- Maximum air operating efficiency
- Make plant expansions easy and economical
- Eliminate shutdowns due to compressor failures
- Air cooling eliminates water bills
- Ease of installation
- Reduced maintenance and replacement expense

IN LINE with today's trend toward employment of small departmental compressors instead of one large centralized machine, Davey offers a complete line of industrial units.

These are available in 60, 105, 160, 210 and 315 c.f.m. capacities. And every Davey has GUARANTEED LIFETIME VALVES.

DAVEY COMPRESSOR CO. • KENT, OHIO

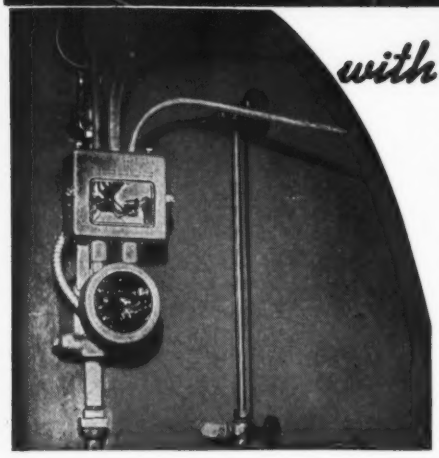
Write for Bulletin E-219

DAVEY

P & P-102

DAVEY COMPRESSOR CO. *Dealers in Principal Cities*

No Waterlogging or Air Binding
in HYDRO-PNEUMATIC TANKS EQUIPPED



with **DUOTROL**

The DUOTROL maintains high water level at a fixed point and correctly balances air pressure after each pumping operation. It provides a maximum volume of water with a minimum of pump operation, saving power and reducing wear. Easy to install, stable adjustments.

The DUOTROL shown is on a tank where water at 50°F is pumped from a 600 ft. well for summer cooling of a complete shopping center. The pressure range is from 30 to 70 lbs.

Ask for Bulletin D-6.

"AUTOMATIC" also makes pressure and float operated pump controls: multi-circuit sequence type, multi-circuit program type, float switches, automatic alternators, and many special controls built to specifications.

AUTOMATIC CONTROL Company
1009 UNIVERSITY AVE., ST. PAUL 4, MINN.

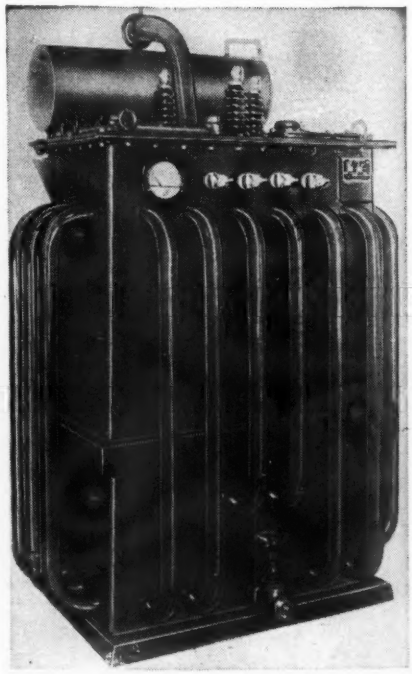
AUTOMATIC CONTROL are used by all leading pump manufacturers. When ordering new pumps, specify controls by AUTOMATIC CONTROL CO.

hose. Simple gas and air adjustments afford a wide range of flame types to fit any application. Torch comes complete with motor, 10 ft of electrical cable, 4-ft stand, and gas and air controls. Gas hose is not furnished. **North American Mfg Co, Cleveland 5, Ohio.**

Split Coupling E458

SUITABLE FOR USE with conduit sizes from ½ to 5 in., this coupling is well adapted to cramped spaces or where it is impossible to screw *L* conduit into ordinary fittings.

With this coupling, a permanent connection is made by butting conduit ends together within the split coupling and tightening down two nuts. Bolt heads are held in place by the coupling shoulder. Spring steel washers prevent these nuts from loosening. The threaded inside of coupling meshes with conduit threads, which assures a permanent connection. **O Z Electrical Mfg Co, 262 Bond St, Brooklyn 2, N. Y.**



Power Transformer E437

THIS TRANSFORMER is equipped with oil expansion tank that is normally half filled with oil and connects directly to main tank. Tank has a gage to indicate oil level, a ventilating breather, and necessary clean-out holes. A pressure-relief diaphragm is provided in the event undue pressure is generated within transformer. Units are available in sizes up to 400 kva and 15,000 v. **Eisler Engrg Co, 750 S 13th St, Newark 3, N. J.**

Flow Alarm E407

AUTOMATIC ELECTRIC-ALARM SYSTEM was developed as an integral part of the company's line of flow indicators. Alarm consists of selectivity controls, a sensitive microswitch and electric wiring to the

The FANMIX BURNER gives you more heat from gas or oil

Increase Boiler Ratings On Present Or Planned Equipment

In all types of Coppus-Dennis FANMIX Burners — straight gas or combination gas-oil — we utilize the energy of the fuel under pressure to drive the burner fan and deliver air in the proper proportion to the fuel flow. This exclusive "pinwheel action" *mechanically* mixes fuel and air in exactly the right proportions for truly radiant, non-luminous heat.

The result is uniform temperature everywhere in the combustion chamber — no drifting "hot spots" — and complete combustion under all conditions. That's why you can release more heat into your present furnace — why in new installations you get more heat into smaller furnace space.

FANMIX Saves On Both Old and New Installations

FANMIX can easily be operated with your present furnace and stack, requiring only minor changes in other equipment. Or if you're planning on new boilers, remember that FANMIX relieves the furnace from the burden of mixing, creates its own forced draft and takes smaller pipe sizes. Which means you can plan on reduced combustion space, less stack, no forced draft equipment and lower installation costs all around.

Get the Whole Story

Coppus engineers FANMIX Burners to meet individual requirements, providing complete control over heat pattern and combustion . . . Learn more about how "pinwheel action" can step up *your* boiler performance to peak efficiency and economy — as it is doing throughout industry. Send for Bulletin 410-5. Coppus Engineering Corporation, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, and REFINERY CATALOG.

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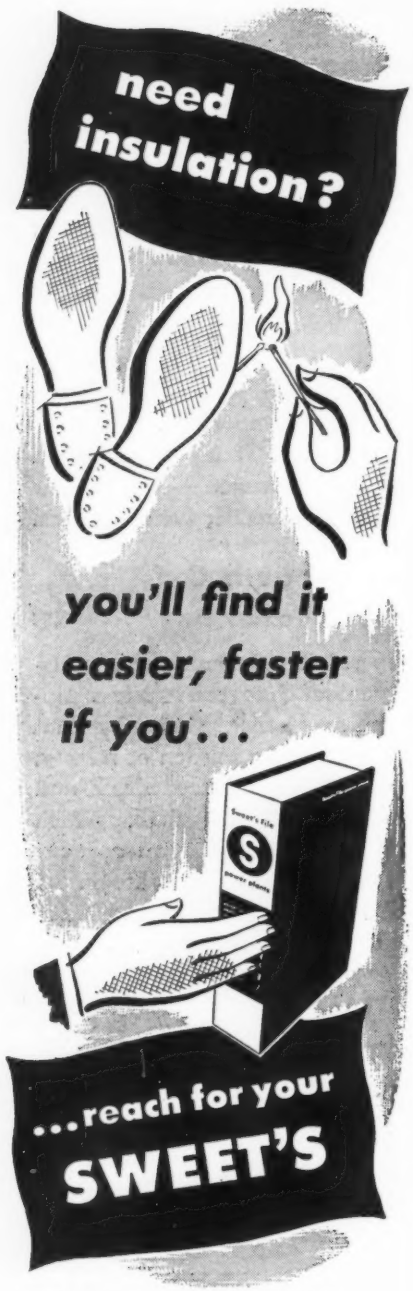

When you need specific information on materials or equipment, reach for your Sweet's File for Power Plants (the big red file). It contains 119 manufacturers' catalogs full of useful information on thousands of products...from absorbers—gas, to zeolite. Cross indexing speeds finding.

If Sweet's File for Power Plants is not available in your office, make request immediately for application form. Files are distributed FREE to qualified organizations and individuals.

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alarm. Pointers of the controls are set at desired maximum and minimum rates of flow and locked with a knob. When rate of flow varies beyond that set by the pointers, microswitch closes contact and sets off an alarm, either a light or audible signal. Device may be set to operate when flow rate exceeds limits of a fraction of a gallon per minute, or will operate at the widest range limit. **Henszey Co, Watertown, Wis.**

Tube Cleaners E418

ROTOJET, JR CLEANERS remove scale and other deposits from tubes as small as 0.495 in. inside diameter. They are suitable for cleaning boilers, condensers, evaporators, superheaters, and other tubular apparatus. *Rotojet* motors are available for operation with air or water. Motor has only two moving parts, a shaft and paddle, which rotate inside an egg-shaped cylinder. A valve behind the motor gives operator instant control of tool. **Elliott Co, Roto Div, 145 Sussex Ave, Newark 1, N. J.**

Tin-Content Indicator E411

INSTRUMENT determines ratio of lead and tin content in solder. It consists essentially of a high-resistance pyrometer and dual thermocouple extensions; one with a lead container, the other with a solder scoop. Instrument obtains percentage of tin content from the difference in temperature between a pure lead standard and a lead-tin alloy sample, while these materials are passing from liquid to solid phase. Lead sample is permanently sealed in one cup, while solder sample to be tested is scooped into the other cup and held there until reading is obtained. Standard scale range is from 0 to 10% tin. **Wheelco Instruments Co, Harrison & Peoria St, Chicago 7, Ill.**

Proportioning Pyrometer E422

MODEL IE486 pyrometer proportions current input to electrically heated furnaces, ovens, plastic molding machines, salt pots and other similar equipment to provide practically straight-line temperature control. It does this by time modulation of input energy. Average energy supplied is proportional to deviation of temperature from the control point throughout a band width, which is adjustable from 0 to 2½% full-scale reading. **Bristol Co, Waterbury 91, Conn.**

Fabric Conveyor Belt E466

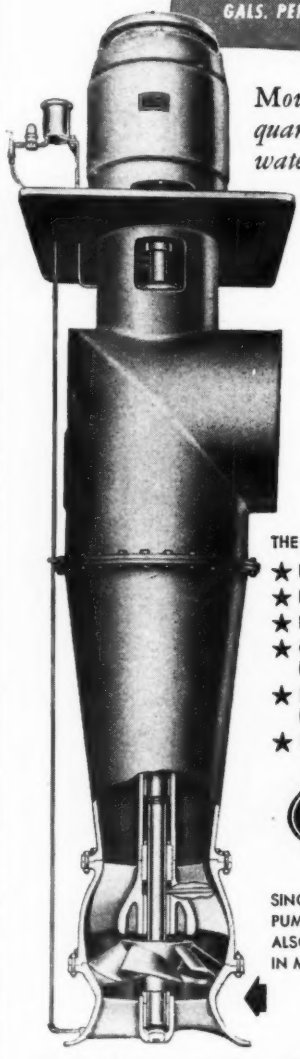
IMPORTANT FEATURES of this new belt include maximum tension, almost double that offered by a 48-oz cotton fabric; excellent transverse flexibility assured by the nylon transverse threads; minimum stretch in actual operation and steel splicing made easy because of fabric construction. Reinforcement of *Raynile* fabric belts is through use of rayon and nylon fabrics bonded to each other. Top cover is securely bonded to carcass by shock-absorbing and distributing-cord breaker. **Hewitt-Robins, Inc, Buffalo 5, N. Y.**

Giants

IN THE WORLD OF PUMPING

PEERLESS MIXED FLOW PUMPS

FROM 600 TO **220,000** GALS. PER MIN.



Move maximum quantities of water against low and medium heads

THE IDEAL PUMP FOR:

- ★ DE-WATERING
- ★ DIVERSION
- ★ DRAINAGE
- ★ CONDENSER COOLING
- ★ FLOOD CONTROL
- ★ PROCESSING

PEERLESS PUMPS

SINGLE STAGE PUMP ILLUSTRATED ALSO AVAILABLE IN MULTI-STAGE

The ideal pump for moving moderate to huge quantities of water against heads from 2 to 60 feet. Available with electric or other types of drive. Hydro-Foil (propeller type) pumps also available for similar services, capacities and heads. *Write for Bulletin B-148 illustrating and describing these pumps.*

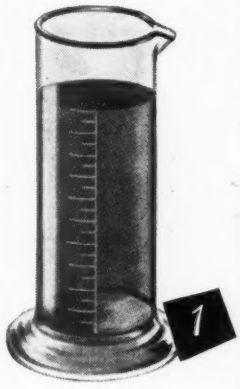
PEERLESS PUMP DIVISION

Food Machinery and Chemical Corporation

FACTORIES: INDIANAPOLIS, IND.; LOS ANGELES 31, CAL.
District Offices: New York 5, 37 Wall Street; Chicago 40, 4554 No. Broadway; Atlanta Office: Rutland Building, Decatur, Georgia; Dallas 1, Texas; Fresno, California; Los Angeles 31, California

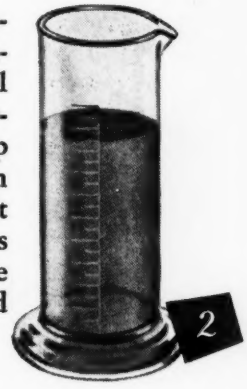
GULFCREST is the only turbine oil refined by the Alchlor Process*

. . . an extra step that removes this 15%

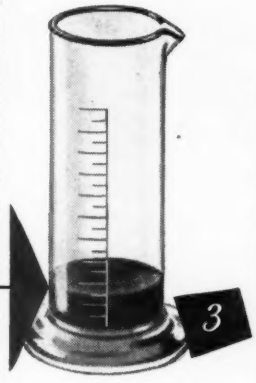


Gulfcrest is the only turbine oil that's Alchlor-processed.* This is an extra refining step. It makes Gulfcrest extra pure and extra efficient.

In Cylinder 1 you see the oil that will become Gulfcrest. It has already gone through the usual steps used in refining other turbine oils — but has not yet been Alchlor-processed.*



In Cylinder 2 you see the finished Gulfcrest—the incomparably pure lubricating oil that gives outstanding performance and helps keep steam turbine systems clean indefinitely. To make it even finer, special inhibitors are added to it — they give it even greater stability and protect against corrosion.



In Cylinder 3 you see the part—approximately 15% —discarded by the Alchlor Process.* This is the part that, when allowed to remain in turbine oil, is most likely to oxidize, increase neutralization number, and form sludge, emulsifiers, and harmful acids.

Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines. Write, wire, or phone your nearest Gulf office.

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Please send me, without obligation, a copy of your new booklet "Gulfcrest Oil for Steam Turbine Lubrication."

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Company.....

Title.....

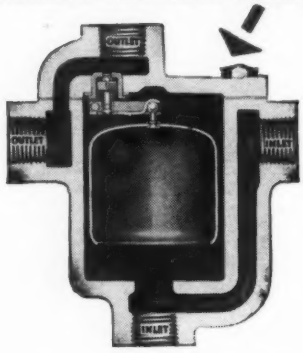
Address.....

CHOOSE CLARK
All down the line

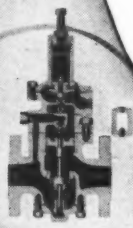
A NEW TRAP JOINS A FAMOUS LINE

Clark Traps

INTRODUCING THE NEW CLARK "60"

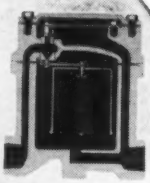


Series "80" Inverted Bucket Steam Trap



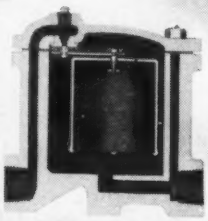
"CRV" Pressure Regulator

A small trap with big trap features. Positive seating with guided disc. Equipped with *two inlets* and *two outlets* for easy installation for horizontal, vertical or angle connections.



Let Clark's 40 years of experience be your guide in selecting the proper trap or valve for your drainage needs.

Series "70-T" Inverted Bucket and Blast Steam Trap



Write today for complete story on Clark Traps and Valves.

THE CLARK MANUFACTURING CO.
1831 EAST 38th STREET • CLEVELAND 14, OHIO

Series "70" Inverted Bucket Steam Trap

Clark

TRAPS — FLOAT, INVERTED BUCKET, OPEN BUCKET AND VACUUM • REDUCING VALVES • STRAINERS

Power News

(*Continued on page* 132)

duction. An improved method of removing tramp iron from coal will be demonstrated, while a number of engineering improvements have greatly improved performance of a well-known spreader stoker. These include an electro-hydraulic drive, alternate-pusher coal feed and an "incremental" control valve for feed regulation.

With smoke prevention coming into critical regard in many communities, there will be considerable interest in a new *Robot-Eye* combustion control that automatically regulates fuel-air ratio for smaller and medium-sized heavy oil-fired boilers, effecting an efficiency that is said to be comparable with larger plants, yet without danger of forming smoke. With a thought for exigencies of the fuel situation there will also be the exhibit of a package-type steam generator that features provision for a quick change-over of the "automatic fuels"—light and heavy oil and gas.

Other exhibits will include extension of the packaged equipment idea to compressor units especially adaptable to needs of smaller industrial plants; also a display of "the only 2-speed portable electric blower manufactured," as well as a new portable all-electric steam cleaner, especially designed for economical plant maintenance.

A newly improved condenser will be offered by a well-known specialist in industrial air conditioning, while a new application for synchronous electric timers will make its bow in a device that provides automatically for periodic cleaning of electrostatic air filters.

Of scientific as well as economic significance is a recently developed method for sterilizing water without aid of either heat or chemicals and without imparting an unpleasant flavor or odor.

In the long line of new instruments already assured for the exposition are a new pyrometer, a multiple recorder that traces four lines on a chart simultaneously, and several newly developed methods of automatic pH control.

Westinghouse Electric Corp's school service has prepared six lithographed wall charts in two colors illustrating important areas of nuclear physics for use in classes in schools and colleges. Measuring 25x36 in. and made of heavy stock, the charts are accompanied by a 32-page book of supplementary information. Price for the complete set is $1.

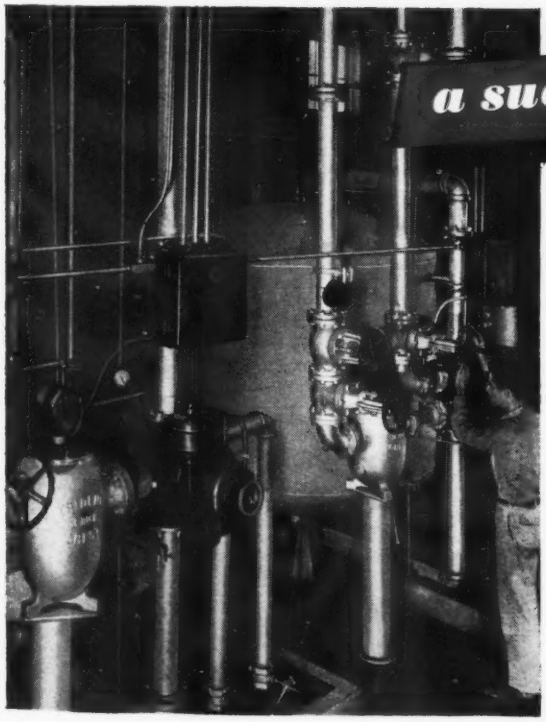
ZERO HARDNESS

ZERO ALKALINITY *

with

ZEO-KARB

a success for over 10 years



Over ten years of successful performance have proven the efficiency of Zeo-Karb** in removing sodium bicarbonate from solution, softening water and simultaneously reducing alkalinity to any desired level.

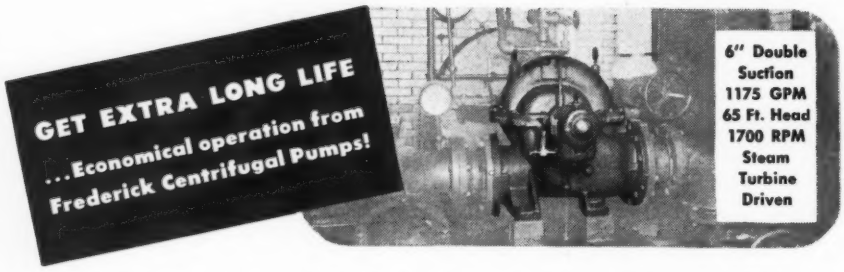
Zeo-Karb also removes sodium, magnesium, calcium, iron, aluminum and manganese from water supplies. Zeo-Karb, with its unlimited tolerance for acid water, will withstand the attack of acid indefinitely. Choose the *proven* water treatment method —use Zeo-Karb made only by Permutit. For full details contact The Permutit Company, Dept. P-11, 330 West 42nd St., New York 18, N. Y. or The Permutit Company of Canada, Ltd., Montreal.

* or any desired value

** Trademark Reg. U. S. Pat. Off.

FOR OVER 35 YEARS
WATER CONDITIONING HEADQUARTERS

Permutit



Twenty-nine years ago, Frederick Iron & Steel manufactured its first centrifugal pump . . . a 6" Double Suction Volute type. Delivered in July, 1919, this pump is still in operation today at the Dominion Coal Co. in Sydney, Nova Scotia. Minor repair parts over the 29-year period have been furnished promptly by Frederick.

Today, Frederick Iron & Steel is manufacturing a complete line of single and double suction, single and multi-stage centrifugal pumps with the same long-lasting quality built into its first unit. When you buy Frederick pumps you're assured of continuous, economical operation from extra long life.

We have among our designs just the centrifugal pump you're looking for. Drop a line to the address below and we'll gladly send you an attractive, illustrated "file-size" brochure on our pumps as well as the name of our factory representative nearest you. Ask for Bulletin 104.

Frederick
ESTABLISHED 1890
IRON AND STEEL, INC.
Dept. P-4 REPRESENTATIVES IN PRINCIPAL CITIES Frederick, Md.

ALSO MANUFACTURERS OF FRECUT AND FREEFORM METALWORKING MACHINERY, FREDERICK STOKERS AND ASH CONVEYORS AND A COMPLETE LINE OF GRAY IRON CASTINGS.

Power Engineers Meet in St. Paul

National Association of Power Engineers held its 65th annual convention and power show at the Municipal Auditorium, St. Paul, Minn., Aug 23 to 27. Attending were about 209 delegates, over 1500 visitors and 500 manufacturers representatives.

First session, called to order by Glen E Copeland, general chairman of the convention committee, featured addresses by Luther W Youngdahl, governor of Minnesota, Joseph P Flynn, national president NAPE, Edward K Delaney, mayor of St. Paul, and Clifton R Harding, national vice-president, NAPE. Morning sessions covered the usual association business reports while afternoons and evenings were devoted to educational features.

CLIFTON R HARDING
President NAPE

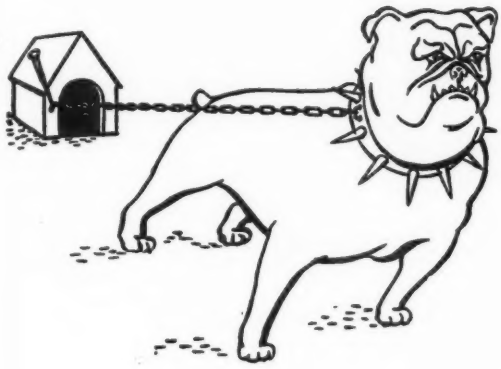
At the final business meeting, Clifton R Harding, master mechanic, power plant, Portsmouth Naval Ship Yard, Portsmouth N. H., and member of Lowell, Mass., Chapter 17, was elected president for the year 1948–49.

Mr Harding was national vice-president last year and is a past president of Lowell Chapter and New England States Association, NAPE. He was national trustee for four years, and is a present member of the board of directors.

Newly elected Vice-President Glen E Copeland is plant superintendent of the State Capitol building, St Paul, Minn. Joining the NAPE in 1924, Glen has filled every office in St. Paul Chapter 7, as well as being a past state president. For the past five years he has been editor of the Minnesota State Association's *Power Engineer's Annual.* As national director for two years he also served on the publication committee. Another of his present jobs is that of state director of the NAPE Competency Plan. He was general chairman of this year's convention and power show.

Officers reelected for another year are: secretary, A F Thompson, Chicago, Ill. and treasurer, Harry J. Harp, Philadelphia, Pa. Next year it will be held in Chicago.

The "Uni-Matic" Oil Purifier is like a WATCHDOG



A DE LAVAL Oil Purifier is always mechanically alert for trouble. Operating on continuous by-pass, it keeps the turbine lubricating oil clean and free from impurities and moisture which normally get into the system. These impurities and water tend to form sludge, so that the Purifier literally helps to prevent sludge formation. Equally important in an emergency is the fact that if an unexpected major water leak develops, the De Laval Purifier can continuously dehydrate the oil and thus prevent serious damage to the turbine.

The "Uni-Matic", the type of De Laval Oil Purifier most generally used, provides a complete oil purification plant, compact and fully enclosed. It includes pumps, gages, and all necessary accessories for keeping oil in the best possible condition. The machine is direct motor driven, self-lubricated, and ball-bearing equipped. The bowl in which purification takes place by centrifugal force is self-draining and of the "constant efficiency" type.

- Write for Bulletin TO-1.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL

LUBRICATING OIL PURIFIERS

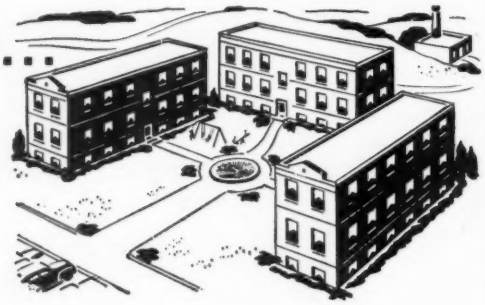
CORAVOL LINES BOILER

CORAVOL CASE HISTORY NO. 1

1st in a series describing CORAVOL results in steam systems

Type of Operation...

HOUSING PROJECT



OPERATING CONDITIONS: Winter months—Average per month.

Evaporation — 8,098,000 lbs.

Make-up — 34,103 gal.

Degree days — 1,296

PROBLEM: Corrosion in steam and return lines. Pitting of receiving tanks. Rust deposits interfered with operation of traps and vacuum pumps.

CORAVOL STARTED: September 1939.

RESULTS: Corrosion stopped. No further deterioration of lines and receiving tank. Traps operate perfectly. All rust deposits removed.

USER COMMENTS: "Pipe pounding and heating complaints have been eliminated. The receiving tank has not been blown down for over a year and the water in it remains as clear as crystal."

STOP STEAM SYSTEM CORROSION

with **CORAVOL** (the original* AMINE PROCESS)

CORAVOL in your steam system (1) prevents corrosion in lines, (2) cleans out clogging rust deposits. Thus, CORAVOL *protects lines;* improves heat transfer; restores original capacity of lines and efficiency of valves and traps.

CORAVOL is *not* a boiler feed water treatment—it is designed expressly for use in steam systems. Because **CORAVOL** volatilizes and condenses with the steam, it circulates throughout your entire steam system and protects *all* zones from corrosive attack.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special formulas of treatment for: boiler feed water . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply.

*The use of CORAVOL in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

WRITE TODAY for complete *free* data about the CORAVOL process.

WESTERN CHEMICAL COMPANY

713 Washington Street — Kansas City 6, Missouri

Bureau of Mines Gives Shale Oil for Research

Under cooperative agreements signed recently with ten large industrial research organizations, Bureau of Mines has agreed to supply limited quantities of oil shale and shale oil for tests and experimentation in exchange for information on the results obtained, Director James Boyd announced. Materials covered in the agreements, now totaling about 1250 tons of shale and 320 barrels of oil, are being shipped from the Bureau's mines and demonstration plant on naval oil-shale reserves near Rifle, Colo.

Cooperating companies and institutions, Boyd said, are Sinclair Refining Co, New York, N. Y.; Standard Oil Development Co, New York, N. Y.; Union Oil Co of Calif., Los Angeles, Calif.; Socony-Vacuum Oil Co, Paulsboro, N. J.; Shell Development Co, San Francisco, Calif.; Phillips Petroleum Co, Bartlesville, Okla.; General Aniline and Film Corp, New York, N. Y.; Montana State College, Bozeman, Mont.; Gulf Research and Development Co, Pittsburgh, Pa.; and Godfrey L Cabot, Inc, Boston, Mass.

Each of the ten organizations has requested samples of shale oil for refining and other tests on conversion of the crude oil into useful products. In addition, Sinclair Refining Co, Standard Oil Development Co and Union Oil Co also are obtaining oil shale for research on development of processes for extraction of the shale oil. Sinclair's work on oil shale will be done at the newly completed laboratories at Harvey, Ill., Standard's at Baton Rouge, La., and Union's at Wilmington, Calif.

Prize awards for best papers on resistance-welding topics submitted in the 1947-1948 national contest were announced recently by a special jury of awards of American Welding Society. All prices were donated to the AWS by Resistance Welder Manufacturers' Assn.

Central Kansas Electric Cooperative Assn plans to install a new 1160-kw diesel generating unit in its Great Bend, Kan., plant. The addition will be financed with part of a $1,260,000 loan from the Rural Electrification Administration. Great Bend plant already contains two 1000-kw diesel units. The cooperative also has a contract with Kansas Power & Light Co for supply of 1000 kw of standby energy. It obtained the REA grant on a showing of need for additional power to serve present and prospective consumers on its distribution system.

Trustees of James F Lincoln Arc Welding Foundation have announced Sept 15, 1948 to April 1, 1949 as the period for submitting entries in its annual engineering undergraduate award and scholarship program. The current competition is the second in a 10-yr series of programs that offer to engineering undergraduates (including agricultural engineers) the opportunity to compete in preparation of papers on various phases of welding for monetary awards as well as scholastic and industry recognition.

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Reader Service Page for . . .

NEW EQUIPMENT and TECHNICAL LITERATURE

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

AIR CONDITIONING, HEATING, REFRIGERATION AND VENTILATION

1 **UNIT HEATER**—Warren Webster & Co, Camden, N. J. 12-page bulletin No. WN-133 gives complete technical story of new Webster-Nesbitt Type R unit heater. Mechanical drawings and charts illustrate design and installation of this unit heater.

2 **AIR FILTER**—American Air Filter Co, Louisville 8, Ky. 12-page bulletin No. 257 describes Electro-PL, Model B, AAF dry-type electronic air filter. Electro-PL advantages are included.

3 **COMMERCIAL FANS**—National Assn of Fan Manufacturers, 5-157 General Motors Bldg, Detroit 2, Mich. 4-page folder No. X-12 gives physical proportions of commercial fans manufactured by member companies.

4 **HEATING AND COOLING COILS**—McQuay, Inc, 1600 Broadway N E, Minneapolis 13, Minn. 28-page catalog No. 300 presents McQuay non-ferrous extended-surface heating coils. 36-page catalog No. 400 covers non-ferrous extended-surface cooling coils.

5 **RADIATION ELEMENTS** — Wilson Engrg Corp, 122 S Michigan Ave, Chicago 3, Ill. 8-page bulletin No. 40 describes characteristics and uses of Wilson All-Cast radiation elements, now made of both aluminum and cast iron by this corporation.

BOILERS AND AUXILIARIES

6 **SMOKE INDICATORS**—Brooke Engrg Co, 4517 Wayne Ave, Philadelphia 44, Pa. 8-page bulletin No. 20-A discusses smoke indicators, recorders and overfire jet controls.

7 **SCOTCH BOILERS**—Brownell Co, 306 N Findlay St, Dayton 1, Ohio. 4-page bulletin No. B-8 gives design and construction of Brownell Scotch boilers. Tables and diagrams are included.

8 **CHEMICAL SOOT REMOVER** — National Aluminate Corp, 6220 West 66th Pl, Chicago 38, Ill. 12-page booklet, entitled "Chemical Removal of Soot and Slag from Boiler Furnaces," gives an abstract of the progress reports made by Battelle Memorial Institute on work done for National Aluminate on this problem.

ELECTRICAL EQUIPMENT

9 **MOTORS FOR POWER-HOUSE AUXILIARIES** — Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 28-page bulletin No. 05B-6107A describes Allis-Chalmers motors of one hp or larger for driving power-house auxiliaries.

10 **SOLDERLESS CONNECTORS** — Reliable Electric Co, 3145 Carroll Ave, Chicago 12, Ill. Binder has a series of five catalogs on the company's complete line of products. Individual catalogs cover solderless connectors, straightline splices and deadends, splicing sleeves, cable specialties, and telephone protective and terminal equipment.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **MOTOR LEAD MARKERS AND CONNECTION DIAGRAMS** — Dept 93, W H Brady Co, 815 N Third St,

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

Example

Write here number of item in which you are interested → E17

Your Company Name: Brown Mfg. Co.

Address: 3718 First Avenue, Pottsville, Okla.

Your Name: John Smith

Your Title: Power Engineer

POWER, 330 West 42nd St., New York 18, N. Y.

FILL OUT AND MAIL TODAY! NOT GOOD AFTER FEB. 1, 1949

Write in circle number of equipment item on which data is wanted →

Your Company Name.....

Address .....

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Your Name .....

Your Title .....

POWER, 330 West 42nd St., New York 18, N. Y. 11/48

Write in circle number of equipment item on which data is wanted →

Your Company Name.....

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Your Name .....

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POWER, 330 West 42nd St., New York 18, N. Y. 11/48

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POWER, 330 West 42nd St., New York 18, N. Y. 11/48

Milwaukee 3, Wis. 4-page folder MD introduces Hi-Heat resistant motor lead markers and motor connection diagrams on Brady self-adhesive Quik-Labels.

11 **SYNCHRONOUS MOTORS**—Electric Products Co, 1725 Clarkstone Rd, Cleveland 12, Ohio. 4-page bulletin No. 211 describes synchronous motors from 10 to 1000 hp. Construction details are given.

12 **MOTOR GENERATORS** — Electric Products Co, 1725 Clarkstone Rd, Cleveland 12, Ohio. 12-page buletin No. 207 presents construction features of E P diverter-pole motor generators. Advantages of these motor generators are discussed. 12-page bulletin No. 209 covers operation of EP diverter-pole motor generators.

13 **INDUCTION MOTORS**—Electric Machinery Mfg Co, Minneapolis 13, Minn. Bulletin No. 1300-PRD-190 covers two pole and bulletin No. 1300-PRD-189 four or more pole heavy-duty squirrel-cage induction motors. Cut-away and sectional drawings show details of welded frame construction, protective design, modern bearings and multi-layer insulation.

14 **SYNCHRONOUS MOTORS**—Electric Machinery Mfg Co, Minneapolis 13, Minn. Bulletin No. 1300-PRD-175 discusses low-speed (below 500 rpm) and bulletin No. 1100-PRD-181 describes high-speed (above 500 rpm) bracket- and pedestal-type synchronous motors. Application advantages and installation pictures are included in both bulletins.

MAINTENANCE AND SAFETY EQUIPMENT

15 **CENTRALIZED LUBRICATION** — Farval Corp, 3293 E 80th St, Cleveland 4, Ohio. 8-page booklet gives concrete examples of savings that have been made on some of the machines in modern industry through use of Farval centralized lubrication.

16 **METALLIZING EQUIPMENT**—Metallizing Engrg Co, 38-14 30th St, Long Island City 1, N. Y. 8-page catalog No. 401 describes metallizing guns, air and gas controls, spray booths and dust collectors, blast machines and nozzles, and air compressors to give clean, dry air.

17 **DRILL PRESS**—South Bend Lathe Works, 425 E Madison St, South Bend 22, Ind. 8-page catalog No. 400 discusses the new South Bend 14-in. precision drill press and drill press attachments and accessories.

METERS AND INSTRUMENTS, MECHANICAL

18 **ROTAMETERS AND FLOW INDICATORS**—Schutte and Koerting Co, 12th and Thompson St, Philadelphia 22, Pa. 4-page bulletin No. 18-RA describes various rotameters and flow indicators manufactured by the company.

19 **INSTRUMENT SYSTEM**—Automatic Temperature Control Co, 5212 Pulaski Ave, Philadelphia 44, Pa. 8-page catalog No. R-10 covers the new A1C instrument system Atcotran, a device for measuring, indicating, recording and controlling pressure, flow, level, humidity, temperature, density, weight, vacuum, draft and thickness.

20 **MICROMETERS, GAGES** — George Scherr Co, 200 Lafayette St, New York 12 N. Y. 28-page catalog presents Scherr line of micrometers, height gages, vernier callpers, dial indicators, etc.

21 **TACHOMETERS** — Metron Instrument Co, 432 Lincoln St, Denver 9, Colo. 4-page bulletin No. 104 discusses electric tachometers for all installations. Several tachometer heads are shown for industrial, marine, railway, diesel and aircraft applications and for direct head coupling from one to 100,000 rpm.

PIPING, FITTINGS, VALVES AND SPECIALTIES

22 **VALVE LINE**—Klipfel Mfg Co, 1000 Weller Ave, Hamilton, Ohio. 24-page bulletin No. 146 describes thirty types of Klipfel reducing valves. 16-page bulletin No. 346 presents several kinds of float valves for proper selection. 8-page bulletin No. 443 discusses six improved vapor pressure operated thermostats, including single-seated thermostatic valves for tight closing.

23 **BRONZE AND IRON BODY VALVES** — Stockham Pipe Fittings Co, Birmingham, Ala. 80-page booklet covers Stockham bronze and iron body valves, templates for drilling bronze and cast iron flanges, locations for taps, drains, bosses on flanged fittings, American Standard taper pipe threads, normal thread engagement for pipe joints.

24 **STAINLESS PIPING SYSTEMS** — Taylor Forge & Pipe Works, P O Box 485, Chicago 90, Ill. 4-page bulletin No. 483 on flanged piping includes drawings, dimensions and prices of new type fittings and flanges, available in Stainless 304, 347, 316 and other materials.

OTHER EQUIPMENT

25 **MAGNETIC STARTERS** — Ward Leonard Electric Co, 31 South St, Mt. Vernon, N. Y. 8-page bulletin No. 4110 describes new line of ac magnetic starters of the across-the-line, non-reversing type.

26 **LUBRICANTS** — E F Houghton & Co, 303 W Lehigh Ave, Philadelphia 33, Pa. 6-page folder lists Houghton products by trade name and their individual applications. They include such catagories as lubricants, metal working, textile processing, leather oils and greases, and hydraulic and transmission products.

27 **RUST-PREVENTIVE PRODUCTS**—Rust-Oleum Corp, 2425 Oakton St, Evanston, Ill. Catalog, entitled "Rust-Oleum Stops and Prevents Rust," outlines qualities of the company's laboratory-and-field tested rust-preventive products for industrial, railroad, marine, farm and general applications.

28 **PLATFORM AND BENCH SCALES** —Yale & Towne Mfg Co, 4530 Tacony St, Philadelphia 24, Pa. Bulletins

(*Continued on page* 180)

FIRST CLASS
PERMIT No. 64
(Sec.510,P.L.&R.)
NEW YORK,N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c. Postage Will Be Paid by—

POWER

330 West 42nd Street

New York 18, N. Y.

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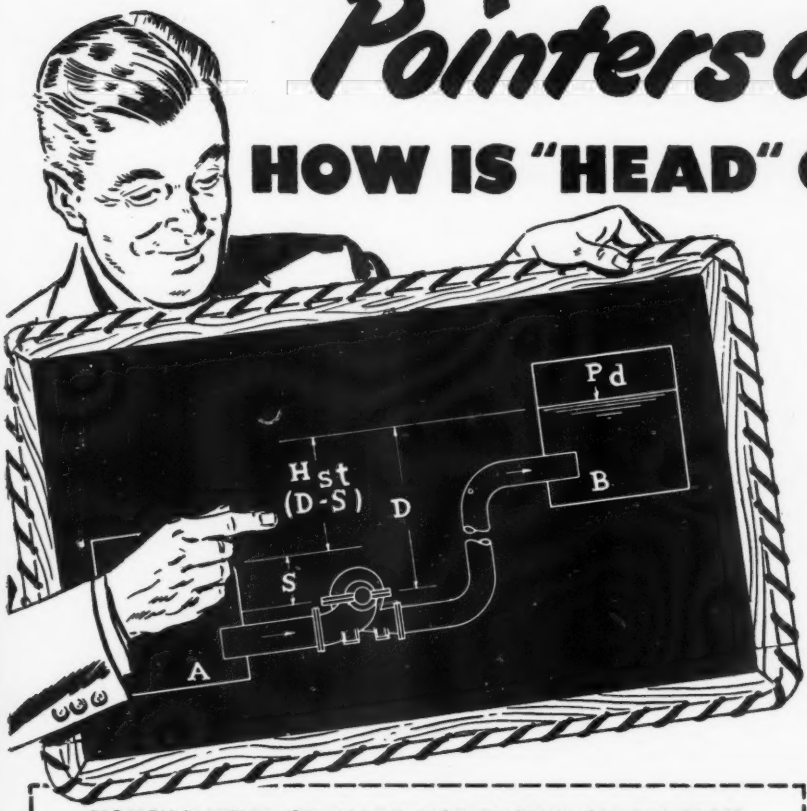
Pointers on Pumps

HOW IS "HEAD" CALCULATED?



The total head of a centrifugal pump is the energy it imparts to the liquid, and is determined by finding the difference between discharge head and suction head. Thus, as a suction lift is a negative suction head, the total head is the sum of the discharge head and the suction lift.

If the discharge head and the suction head are not determined independently, the total head can be calculated by determining the algebraic sum of (1) the static head from supply level to discharge level, (2) all friction losses for the capacity considered, (3) entrance and exit losses and, (4) terminal pressure minus suction supply pressure. For complex systems involving both vacuums and pressures it is often easier to convert these factors into absolute pressure values, expressed in feet of the liquid handled.

When measured by gages at the pump's suction and discharge opening, the total head is the discharge head minus the suction head. Discharge head is the sum of the discharge gage reading, corrected to the pump center line, and the velocity head at the point of the gage's attachment. Suction head is found by applying the same formula to the suction gage reading. Since it is easy to get the plus and minus signs of the various elements reversed, and because of the many precautions necessary in taking gage readings, it is advisable to follow the instructions in the Test Code of the Hydraulic Institute.

The diagram shows the heads involved in calculating suction head, discharge head, total head and NPSH. (The term "NPSH" was discussed in a previous advertisement in this series. Reprints are available on request.)

NOMENCLATURE OF HEADS NOT SHOWN ON DIAGRAM

h_{fs} = friction head loss in suction line

h_{fd} = friction head loss in discharge line

h_f = total friction head loss from A to B

*h_i entrance loss at A

*h_e = exit loss at B

P_{vp} = vapor pressure of liquid at pumping temperature

All heads and pressures must be expressed in feet of liquid with proper algebraic signs. Pressures P_s, P_d and P_{vp} can be either in gage or absolute values but, in any case, must all be measured above the same datum.

*Some engineers include these losses in h_{fs} and h_{fd}.

$$\text{SUCTION HEAD} \quad h_s = S - h_{fs} - h_i + P_s$$

$$\text{DISCHARGE HEAD} \quad h_d = D + h_{fd} + h_e + P_d$$

$$\text{TOTAL HEAD} \quad H = h_d - h_s$$

$$= H_{st} + h_f + h_i + h_e + (P_d - P_s)$$

$$\text{NPSH} \quad = S - h_{fs} - h_i + P_s - P_{vp}$$

(To convert pressures in psi to feet of liquid, multiply by 2.31 and divide by specific gravity of the liquid at pumping temperature.)

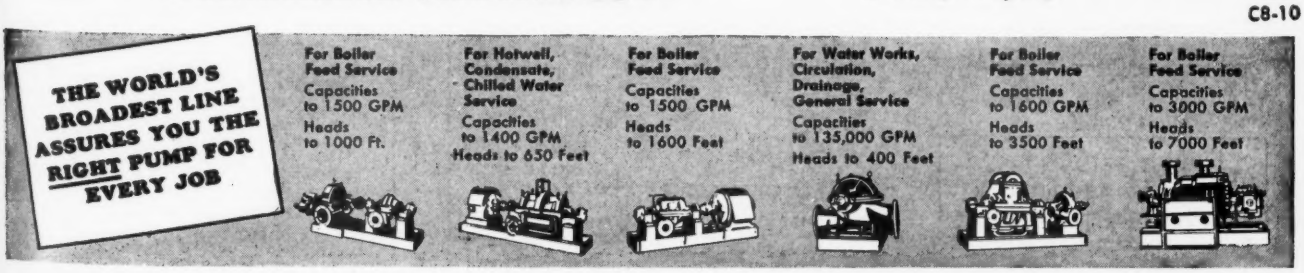
Worthington's Complete Line

of centrifugal pumps includes all pressures and capacities. For expert advice on any pumping problem — and further details proving *there's more worth in Worthington* — contact our nearest District Office. Or write to *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, New Jersey.*

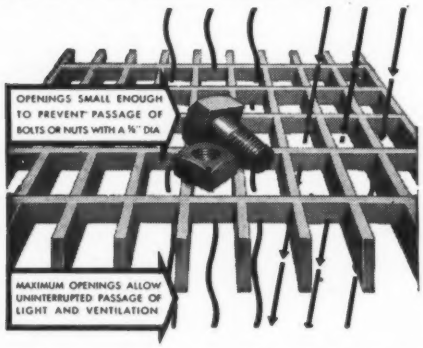
C8-10

WORTHINGTON

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB


For Boiler Feed Service
Capacities to 1500 GPM
Heads to 1000 Ft.
For Hotwell, Condensate, Chilled Water Service
Capacities to 1400 GPM
Heads to 650 Feet
For Boiler Feed Service
Capacities to 1500 GPM
Heads to 1600 Feet
For Water Works, Circulation, Drainage, General Service
Capacities to 135,000 GPM
Heads to 400 Feet
For Boiler Feed Service
Capacities to 1600 GPM
Heads to 3500 Feet
For Boiler Feed Service
Capacities to 3000 GPM
Heads to 7000 Feet

TRI-LOK RECTANGULAR OPEN STEEL FLOORING


OPENINGS SMALL ENOUGH TO PREVENT PASSAGE OF BOLTS OR NUTS WITH A ½" DIA.
MAXIMUM OPENINGS ALLOW UNINTERRUPTED PASSAGE OF LIGHT AND VENTILATION

Tri-Lok strength is obtained by truss action through twisted cross-bar, curved in opposite directions at each bearing-bar. Standard openings in Tri-Lok Rectangular Steel Flooring are 1" x 3⅞"—other size openings can be supplied as required.

Diagonal, or Super-Safety U-type Flooring, and stair treads of all types, are available. Bulletin KF 1140 describes the construction features of Tri-Lok Open Steel Flooring.

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"GUNITE" Concrete

(since 1915)

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UPTAKES •
BREECHINGS •
STEEL & PIPE •
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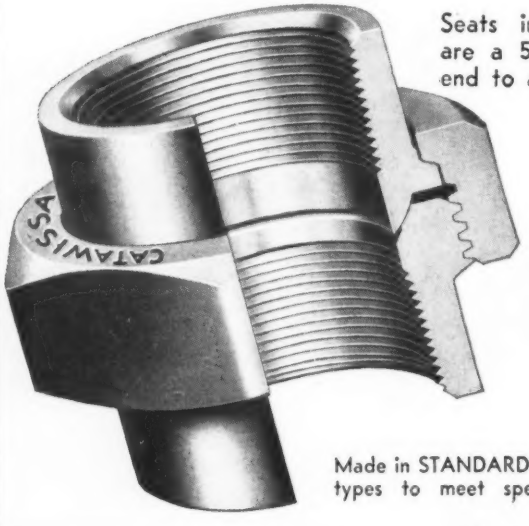
CATAWISSA UNIONS

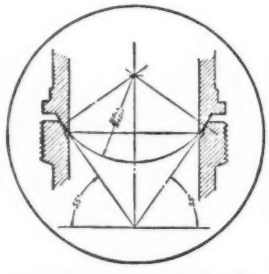
- HOT FORGED STEEL
- STAINLESS STEEL

give you a PERFECT SEAL

even when the pipe is not in perfect alignment!



Seats in all Catawissa Unions are a 55° angle on the female end to a BALL on the male end —assuring good, tight, leakproof joints!



Made in STANDARD and DOUBLE EXTRA HEAVY types to meet specific pressure requirements!

Double Extra Heavy Hot Forged Steel SWING CHECK VALVES

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CATAWISSA VALVE & FITTINGS CO.
206 Mill St. • CATAWISSA, PA.

New Bulletins

(*Continued from page* 178b)

on portable platform scales and bench scales (P-714D and P-714F) emphasize proper selection of the right model for the job.

29 MAGNETIC PULLEYS AND SEPARATORS—Dings Magnetic Separator Co, 4740 W McGeogh Ave, Milwaukee 14, Wis. 6-page catalog No. 260-A presents Dings Alnico magnetic Perma pulley. 28-page catalog gives operation details, advantages and specifications of Dings magnetic pulleys and pulley type separators.

30 NICKEL SPECIALTIES — International Nickel Co, 67 Wall St, New York 5, N. Y. 24-page catalog, entitled "Standard Specialties," gives about 200 standard products made of Monel, nickel or Inconel for corrosive and high-temperature service.

31 ZINC APPLICATIONS—New Jersey Zinc Co, 160 Front St, New York 7, N. Y. 8-page folder discusses the many applications for zinc. Photos are included.

32 ANALYTICAL INSTRUMENTS — Consolidated Engrg Corp, 620 N Lake Ave, Pasadena 4, Calif. 16-page catalog, entitled "Analytical Instruments for Science and Industry," covers all instruments designed and manufactured by the company. Instruments in the catalog are divided into two sections: mass spectrometry, and static-dynamic measuring and recording.

33 THERMAL CONDUCTIVITY UNIT —Gow-Mac Instrument Co, 22 Lawrence St, Newark 5, N. J. 4-page bulletin No. BF848 on Ever-Tite thermal conductivity unit tells what it does, why it's dependable and where it's used. Table gives typical deflection values.

34 PUMPS — Economy Pumps, Inc, Hamilton, Ohio. 8-page catalog No. D246 covers Type SCV general-purpose pump, suitable for cold-water circulation, hot-water circulation, brine circulation, sprinkler systems, etc. 16-page catalog No. F245 gives details of construction and design of vertical non-clogging open-shaft pumps. 8-page catalog No. C746 discusses Type DMD ball-bearing 2-stage pumps in capacities from 75 to 700 gpm, for heads from 175 to 400 ft at 1750 rpm.

35 WELDING PRODUCTS — American Manganese Steel Div, American Brake Shoe Co, Chicago Heights, Ill. 16-page schedule No. W-1 contains price information on hard-facing, build-up rods, electrodes and weldments.

FUELS and FIRING

48 pages of practical information on how fuels burn, properties of commercial fuels firing equipment for gas, oil and coal, tips on selecting fuels, and short-cut methods for checking efficiency.

POWER
December 1948

Able Helmsmen Needed-

WITH our way of life threatened and even our motives for helping others discredited, we drift toward destruction of the very thing that makes America the envy of the world --individual liberty. Who can steer our course, to save our craft from wreck?

It is *your* job. You, as a leader in your community, must help arouse public opinion to a full appreciation of America's sacred heritage of freedom for the individual. You owe it to yourself, your family, your neighbor and your nation, to give of your experience and knowledge to pilot us safe through the storm.

These tempestuous times demand the intelligent work of leaders in every community to preserve America as the impregnable vessel of liberty and freedom. Here then, is important work for able helmsmen.

The Youngstown Sheet and Tube Company

General Offices -- Youngstown 1, Ohio

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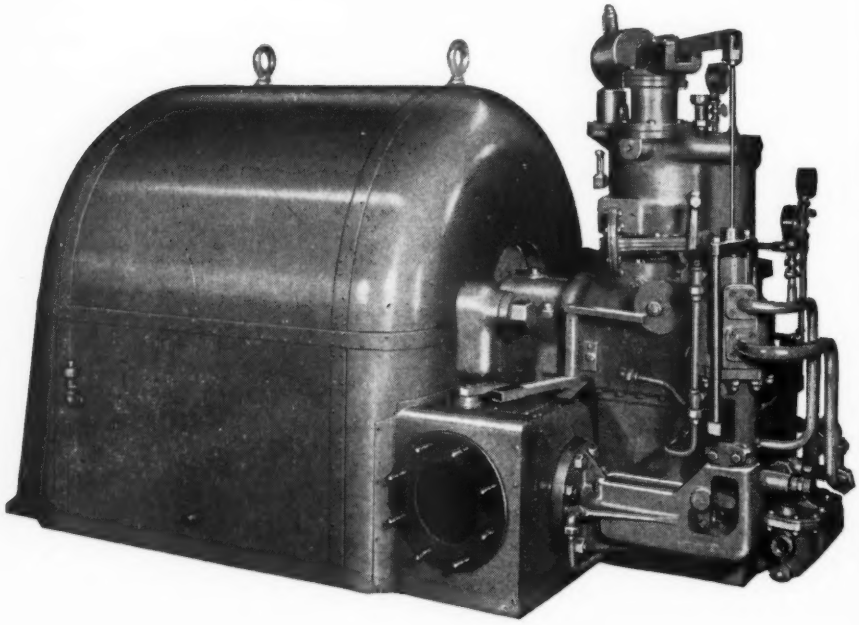
MANUFACTURERS OF CARBON, ALLOY AND YOLOY STEELS

COLD FINISHED CARBON AND ALLOY BARS · SHEETS · PLATES · WIRE · TIE PLATES AND SPIKES · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · PIPE AND TUBULAR PRODUCTS · CONDUIT · BARS · RODS.

MURRAY
TYPE UV



MULTI-STAGE STEAM TURBINES

Simplicity and reliability characterize the Murray Type UV Turbine. Available in from two to ten pressure stages on two basic pitch diameters. The Type UV can be supplied in capacities from 100 to 4000 HP, condensing or non-condensing. It can be used for mechanical drives or for smaller generator drives.

Murray Type UV is durably built for dependable performance. Horizontally split case construction to suit operating conditions. Blades are stainless steel, shafts of alloy steel. The assembled rotors are dynamically balanced. Governors are provided to suit specific job requirements.

Let our engineers cooperate in smoothing out your power problems.

WRITE FOR BULLETIN T-122

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY

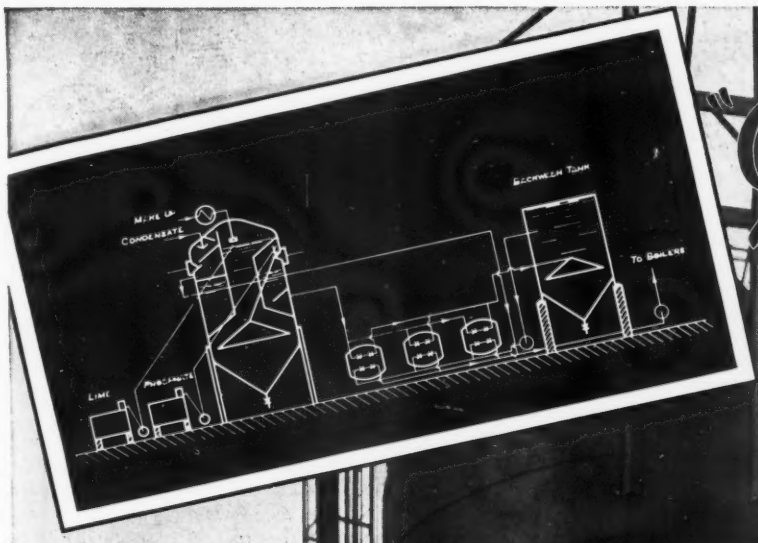
Philip D Reed, chairman of board of General Electric Co, has been elected chairman of research and policy committee of Committee for Economic Development. In this capacity he will direct research activities of this organization, succeeding Raymond Rubicam whose term has expired. The announcement was made by W Walter Williams, of Seattle, chairman of CED, at a press conference in New York at which he and Reed outlined a broad program of research to be undertaken by CED as a permanent organization.

In announcing a new program detailing perplexing areas of our economy to which CED will devote its immediate research studies, Reed listed the following: (1) safeguards against extremes of economic instability—fiscal and monetary policy to combat inflation and deflation (2) how to raise real wages—money wage rates vs real wage rates vs real labor incomes—putting more purchasing power in the pay envelope (3) federal tax policy for 1949 (4) international economic readjustment (5) allocation of resources in a defense economy (6) how to keep our economic and individual freedoms in a garrison state.

Pacific Gas & Electric Co has announced plans for construction of two 300,000-kw steam-operated electric-generating plants, one near Moss Landing and the other near Oakland, Calif. The two plants, each to cost about $50,000,000, will be the largest ever built in the PG&E system. Each of the plants will have three 100,000-kw generators and will be equipped to burn oil, gas or coal for fuel. The first generating unit in Moss Landing plant is scheduled to go into service early in 1950, with the other two planned for operation a year later. The Sando plant, near Oakland, will go into operation in 1951.

American Society for Testing Materials has issued some 29 standard specifications and tests covering coal and coke, published in a special compilation of 163 pages. The standards are given as of Sept 1948 and incorporate a number of changes, made during the current year. and certain new material. Test methods and procedures pertaining to coal cover sampling, analysis for volatile matter in connection with smoke ordinances, grindability, drop shatter test, tumbler test, screen analysis, size, sieve analysis, cubic-foot weight, index of dustiness and free-swelling. Specifications cover classification of coals by rank and grade. Write to *ASTM headquarters, 1916 Race St, Philadelphia 3, Pa.* for copies of this booklet at $2.00 each.

National Bureau of Standards has announced a revision of fuel-oils commercial standard CS12-40, the revision to be identified as Commercial Standard CS12-48. Purpose of the revision is to bring the standard into line with current refinery practice and burner construction. The specification covers five grades of fuel oil for various burner equipments. Printed copies of Commercial Standard CS12-48 will be available as soon as practicable. Until that time, write to *Commodity Standards Div, National Bureau of Standards, Washington 25, D. C.* for mimeographed copies.



"Concentrated Boiler Water is Always CRYSTAL CLEAR"

SEDIMENTATION TANK OF 1930 COCHRANE SOFTENER NOW USED FOR CLARIFICATION AND STORAGE OF BACKWASH WATER

AT the Lockport, Ill. plant of The Texas Company, expansion of steam facilities made necessary provision for water treatment to meet this expansion. A Cochrane Hot Process Softener of 70,000 gph was installed, replacing a 32,000 gph Cochrane Hot Process Softener which had been in use since 1930. Ingeniously, the sedimentation tank of this old softener is now used for the clarification and storage of backwash water. The Two-Stage Softener was adapted because of the high-carbonate high-hardness waters of the region. The Cochrane Two-Stage method combines the use of lime and soda ash for precipitating the bulk of the hardness, with phosphate to precipitate the remaining hardness. Final attainment of "zero" hardness is in the second stage by means of phosphate While the raw water hardness is extremely variable, operations have been so successful that concentrated boiler water is always crystal clear. Write for details on Two-Stage Softening.

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COCHRANE CORPORATION 85 YEARS OF SERVICE 1863-1948

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HOT PROCESS WATER SOFTENERS

One Man at One Point

. . . Controls All!

With Beaumont Birch Coal Handling Equipment, one operator controls *all* coal handling with finger-tip controls, like this—

Coal arrives by rail, is dumped into hopper, raised by bucket elevator and discharged either into bunker for immediate use or down a chute to yard storage. If it goes to storage, the Beaumont Drag Scraper spreads it into safe, compact layers—eliminating air pockets.

Use any available space. Tail-blocks can be slung between posts and moved by hand—and mechanically moved on I-beam track, by tail-block car, or suspended from an aerial bridle system. The scraper and cable system is operated by *one* man through remote control. *One* company, Beaumont Birch, supplies all necessary equipment.

Complete engineering service available by writing right now to—

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5 vols., 1826 pages, 1724 illustrations

Gives you the "know-how" to tackle any wiring or motor job. Five books show you HOW—to install all types of motor and generator units—to inspect and repair motor starters and generators—to diagnose motor and generator troubles—to figure new windings for old cores, DC and AC windings—to test armature windings, test induction motors, etc., etc. One book is full of trouble-shooting charts that show quickly symptoms, causes, specific remedies, etc.

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BOMBAY, INDIA: American engineering firms are to be retained to supervise construction of the multimillion dollar Domodar Valley irrigation and hydroelectric project in northeast India. Government officials have announced they are studying the matter of whether to entrust the work to a single firm or a group of firms. This would be the second dual-purpose dam project to be turned over to American "know how." Earlier this year it was announced that American firms would be asked to play a major role in the Ramapadasagar dam construction proposed in Madras province. Although there has been some protest from nationalistic interest, both deals are likely to go through if maters of finance and remittances of payments can be arranged.

Bailey Meter Co, Cleveland, Ohio, recently inaugurated its 1948 cadet engineering class. A large group of engineers reported, including several from Canada and one from England. Representation in the class included 23 universities and engineering colleges. R E Sprenkle, director of education, and J H Dennis, assistant director of education, conduct the course.

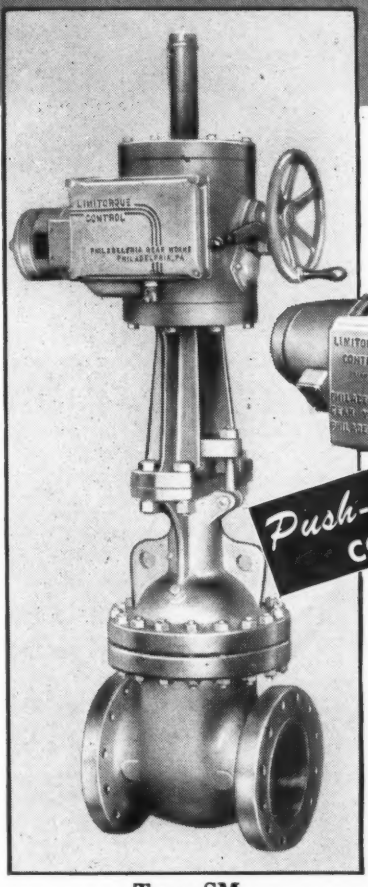
Georgia Power Co is to start construction soon on a new steam-electric generating station that eventually will be of 400,000-kw capacity, the largest in the South. Initial construction at the new plant will be for a 100,000-kw unit at a cost of $10,500,000, including transmission lines. It is expected to go into operation in the fall of 1950. The generator and boilers have been on order for some time. President C B McManus said that the new plant will be in Coweta County across the Chattahoochee River from Whitesburg, between Newman and Carrollton. Power from the plant will go mainly to Atlanta, Newman, LaGrange and West Point, industrial and textile centers.

Distribution of an additional 147,000,000 cu ft of natural gas daily in Chicago and northern Ill. area came a step closer with recent shipment by Midwest Piping & Supply Co, St. Louis, of a final consignment of fabricated piping for the new Texas-Chicago pipeline of Natural Gas Pipeline Co of America. As pipeline laying crews and suppliers meet schedules, the new line is expected to be in full operation by midwinter. The line, which parallels and supplements one built in 1931, will increase daily supply of natural gas in Chicago from 229,000,000 cu ft to about 376,000,000 cu ft. It is partially operating already in an auxiliary capacity to the old line throughout most of its 900-mile length.

Positive, Safe and Automatic

VALVE OPERATION

with **LIMITORQUE VALVE CONTROLS**



Type SM

Type GS

LimiTorque is a sensitive, automatic, mechanically actuated device for opening and closing globe, gate, penstock and rotary plug valves; sluice gates; garage, factory and hangar doors; induced and forced damper controls; sprinkler systems; feeder dis-connect switches; watertight bulkhead doors, etc. Most valves are damaged by improper seating, or by meeting some obstruction in closing . . . *LimiTorque control* gives absolute assurance against improper seating, by means of a *positive safety* overload mechanical torque cut-out. If obstruction is met in closing valve, the torque switch becomes operative, and dis-connects the motive power—thus preventing broken gates or discs and damaged stems. Philadelphia *LimiTorque* is the *only* automatic valve operating device that employs this positive principle of operation and control.

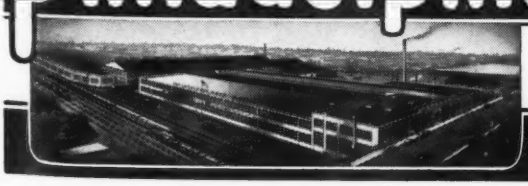
LimiTorque, with all its remarkable sensitiveness, is a simple piece of mechanism, containing as few parts as possible. No de-clutching coils are necessary . . . if the current is available at the motor terminal, *LimiTorque* will function regardless of whether valve was last operated manually or electrically. Opening and closing stops are pre-determined to suit application,—and operation may be by push-button, automatic, or manual control.

LimiTorque Controls are designed by engineers who were directly associated with the development of the original mechanical valve operators.

Hundreds of "*LimiTorques*" are used in Central Stations, Power Plants, Refineries, Oil Pipe Lines, Water and Sewerage Plants, on Shipboard, etc.

Send for this 96-page Catalog, and please use your Business Letterhead when writing.

Philadelphia Gear Works, INC.



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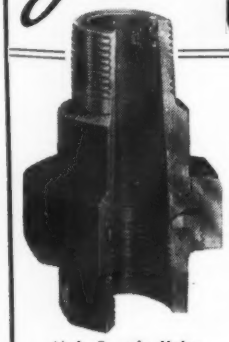
Industrial Gears and Speed Reducers
LimiTorque Valve Controls

Jefferson UNIONS



Male-Female Union

. . . made in ALL types for ALL needs . . . with the

Exclusive RECESSED BRASS SEAT

Completeness of the Jefferson Union line in types and sizes makes it possible to greatly simplify piping installation and maintenance. The Male-Female Union shown, for example, can be used instead of an all-female union and a nipple, thereby saving one joint.

Other types in the Jefferson line include 45° and 90° Union Elbows and Union Tees . . . all with the leak-proof, easily set up, self-seating ball joint located in a recess away from the runway of the fitting . . . an exclusive Jefferson feature.

Consult us or your nearest distributor on your requirements

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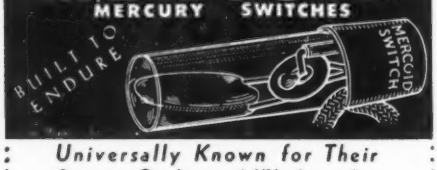
MERCOID
MERCURY SWITCHES



Universally Known for Their Superior Quality and Workmanship

They are not affected by dust, dirt or corrosion and have many definite applications where open contacts are not suitable. Various types available. MERCOID is your guarantee of the best in mercury switches. Further information sent upon request.

LET MERCOID SOLVE YOUR CONTROL PROBLEMS

MERCOID CONTROLS WITH MERCURY CONTACT SWITCH rank first for convenience of adjustment—dependable service and long life.

They are designed for various applications requiring the control of pressure, temperature, liquid level and mechanical operation.

AVAILABLE IN EXPLOSION-PROOF CASE FOR HAZARDOUS LOCATIONS

Complete Mercoid Catalog sent upon request.

THE MERCOID CORPORATION, 4201 BELMONT AVE., CHICAGO 41, ILL.

APPOINTMENTS

Babcock & Wilcox Co has appointed Robert J Powell refractory sales engineer for Alabama, Tennessee, and western Georgia and Florida. His offices are at 1604 Candler Bldg, Atlanta, Ga. A Dawson Teague remains refractory sales engineer for North Carolina, South Carolina, eastern Georgia and Florida.

Andrews Agency, Milwaukee, Wis. is now handling all advertising for **Buda Co,** Harvey, Ill.

Allis-Chalmers Mfg Co named John Druml and Samuel W Ouweneel chief inspectors of the general machinery and tractor divisions, respectively. They succeeded G William Warner, retired.

Lawrence L Weldy joined the staff of **Electric Power Equipment Corp,** Philadelphia, as sales representative for northern Illinois, Iowa, eastern Wisconsin, Gary, Ind. and surrounding territory.

Farrel-Birmingham Co, Ansonia, Conn., announced appointment of Carl F ter Weele as export manager. He will make his headquarters at the firm's New York City office, 3700 Chrysler Bldg.

P J Jensen succeeds M E Knoll, who is retiring, as Michigan district manager for **Carboloy Co.** He will remain in Detroit.

J H Williams & Co, Buffalo, N. Y., has opened a warehouse and sales office at 2266 E 38 St, Los Angeles, Calif. Charles F Coates, newly appointed western district sales manager, is in charge.

Parker F Wilson was elected president and director of **Kerotest Mfg Co.** Former president, Walter G Swaney, became vice-chairman of the board.

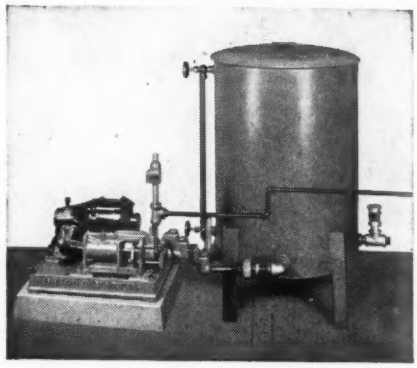
James P Marsh Corp purchased the Witt gauge div of National Pressure Cooker Co, Eau Claire, Wis. Identity of the Witt line will be preserved, but Witt gages, including the oxygen and welding gages, will be produced in the Marsh plant.

Gerald T Haddock has been made American sales representative for **Lafarge Aluminous Cement Co, Ltd,** London, England. He will handle sales of Ciment Fondu Lafarge in the United States, with New York City as his headquarters.

Ampco Metal, Inc, Milwaukee, announces following appointments and changes: J P Henry succeeds S C Lawson as assistant general sales manager. Lawson was promoted to general sales manager. R J Thompson is now located in California, serving as engineering and sales manager for the firm's west coast activities. W F Taff is the new manager of the Indianapolis district; F A Burnett was transferred from Indianapolis to Cincinnati as district manager; and J E Cook from Cincinnati to Philadelphia as district manager.

Chemical Pump & Equipment Corp, 75 West St, New York 6, N. Y., is now representing the process equipment dept of

MILTON Roy CHEMICAL PUMPS



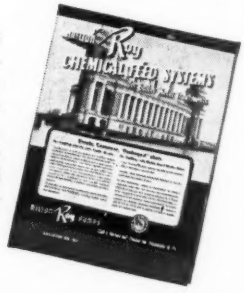
Complete Feed Systems for Boiler Water Chemical Treatment

Milton Roy "Packaged" Units for chemically treating boiler water are available to feed sodium sulfite into the suction side of the feed water pump and to feed other chemicals, such as phosphates, soda ash and caustic directly into each boiler. Both methods are usually recommended for the correct treatment of boiler water.

- TO REMOVE DISSOLVED OXYGEN, INSURE AGAINST CORROSION AND PREVENT PITTING.
- TO PREVENT SCALE FORMATIONS, CONTROL ALKALINITY AND PREVENT EMBRITTLEMENT.

Units are complete with Milton Roy Pumps, tanks, gages, low-level pump cutouts and alarms . . . are available in a wide range of capacities to meet all requirements. Complete electronic controls and meters can be supplied to operate pumps automatically at rates directly proportional to feed water flow.

Write for Bulletin 451 also Technical Paper 51 "What the Power Engineer Needs to Know About Chemical Feed Systems for Water Treatment."



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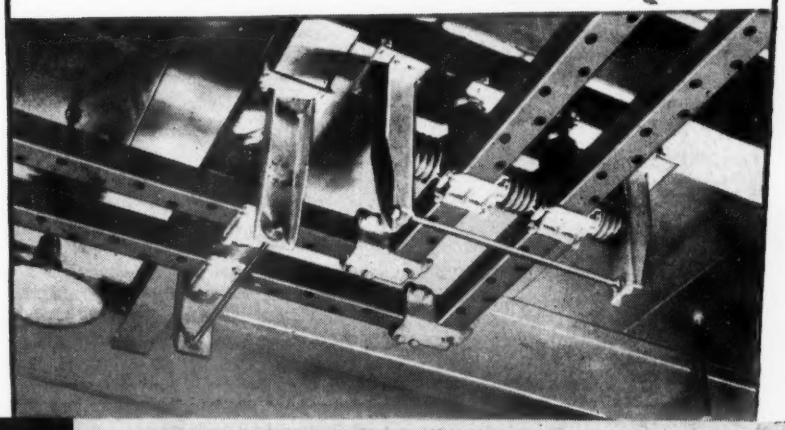
SQUARE COPPER TUBE
BUS CONDUCTORS



CHECK THESE OUTSTANDING ADVANTAGES

LOOK at this summary of the advantages of Chase Square Copper Tube Bus Conductors: High Electrical and Thermal Conductivity — High Current-Carrying Capacity — Great Mechanical Strength *in all directions*— Efficient Joints and Connections easily made—Easily Assembled and Erected —Highly Resistant to Corrosion!

This is the type of rugged, high quality bus tube *you* want. For full specifications and information clip and send coupon today!

SEND FOR ILLUSTRATED BOOKLET!

New detailed literature, with physical and electrical characteristics of both the ventilated and unventilated square copper tube bus . . . plus physical and electrical characteristics of standard copper pipe and rectangular copper bar . . . will be on the way to you, upon our receipt of the coupon below.

Chase Brass & Copper Co., Dept., PO118
Waterbury 91, Conn.
Please forward your new booklet about Chase Square Copper Tube Bus Conductors to:

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Company_____
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Chase
the Nation's Headquarters for
BRASS & COPPER

WATERBURY 91, CONNECTICUT — SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WATERBURY (†Indicates Sales Office Only)

IMO—
The PREFERRED
PUMP for
OIL BURNERS

IMO pumps provide the steady, pulsation-free delivery conducive to a steady flame and efficient combustion.

The IMO is a positive displacement rotary pump of unique design having no pistons, valves, sliding vanes, or intermeshing gears to cause intermittent delivery.

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Makes
ALL
VALVES
INSTANTLY
Accessible

CONTROL FROM THE FLOOR

● Instant, handy, safe control of overhead and other out-of-reach valves. Eliminate danger to employees; banish the stepladder. Now — install valves anywhere they should be, regardless of accessibility.

Inexpensive BABBITT Sprocket Rims fit all types and makes of valves, with either rising or non-rising stems. Installed quickly by clamping directly onto hand wheel of valve. Eliminates makeshift apparatus and specially-made chain wheels.

● Ten standard sizes take care of all valve wheels from 2 to 30 inches in diameter.

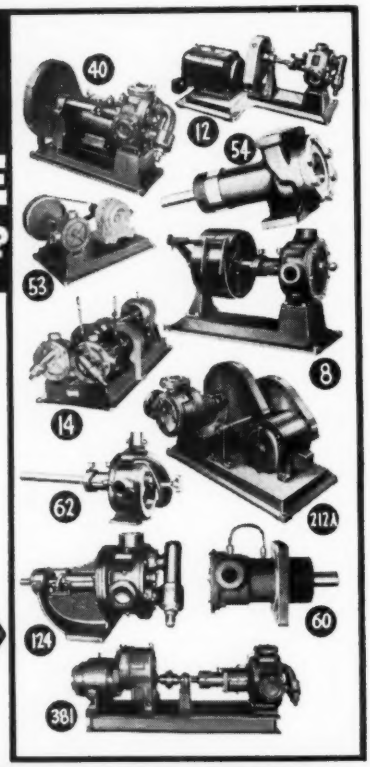
● Request Catalog Bulletin P, prices, name of local distributor:

Babbitt
Adjustable
SPROCKET RIM
with Chain Guide

BABBITT STEAM SPECIALTY COMPANY
New Bedford, Mass., U. S. A.

What will YOU have from the complete
VIKING LINE
of ROTARY PUMPS?

Viking is a specialist in Rotary Pumps of sizes from ⅔ to 1050 gpm, pressures to 200 psi—500 psi on hydraulic oils. Send for free bulletin 47SW today!



Samples of
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VIKING PUMP CO.
CEDAR FALLS IOWA

See Our Catalog In SWEETS

Viking PUMP COMPANY
Cedar Falls, Iowa

Union Iron Works, Erie, Pa. Territory covered is all of New York east of Rochester and western Connecticut.

Philip Carey Mfg Co, Cincinnati, Ohio, has named Frank J Smith advertising and sales promotion manager. He succeeds Harold D Bates, who was promoted to general merchandise manager.

Gerald W Wilson and William F Jordan are the new district representatives in the eastern sales division of **Caterpillar Tractor Co,** Peoria, Ill. Wilson will represent the company in contact with distributors in northern Georgia, South Carolina and eastern Tennessee, while Jordan will contact dealers in northern Ohio, Michigan and West Virginia. Jordan replaces R E Jeffries, who joined Missouri Valley Machinery Co, Caterpillar distributor at Omaha. Wilson succeeds F S Foster, who recently became assistant Eastern sales manager.

Kieley & Mueller has chosen the Charles W Snyder Co, 1001 N Wheeling St, Tulsa 6, Okla., mid-continent distributor for the firm's complete line of automatic valves, level controls and pressure controls.

Sherrill S Deputy, of **American Wheelabrator & Equipment Corp,** Mishawaka, Ind., is now sales manager.

Ward Leonard Electric Co moved its Rochester branch office to 66 South St, Rochester 7, N. Y. Ken Savage remains district manager.

J J Murray was appointed export manager for **Hewitt-Robins, Inc.** Upon his return from Europe, he will maintain headquarters at the firm's executive offices, 370 Lexington Ave, New York 17, N. Y.

Sylvania Electric Products, Inc, has named Edward J. Lynch manager of warehouse service, a newly created dept. Lynch will be in Salem, Mass. and report directly to Walter R. Siebert, assistant controller.

C R Fischer, 632 S 48 St, Philadelphia, Pa., is now sales representative for **Geo P Reintjes Co,** Kansas City, Mo. His territory includes eastern half of Pennsylvania and New Jersey.

Lord Mfg Co, Erie, Pa. announces opening of Dayton, Ohio office at 238 Lafayette St, in charge of W W Dalton.

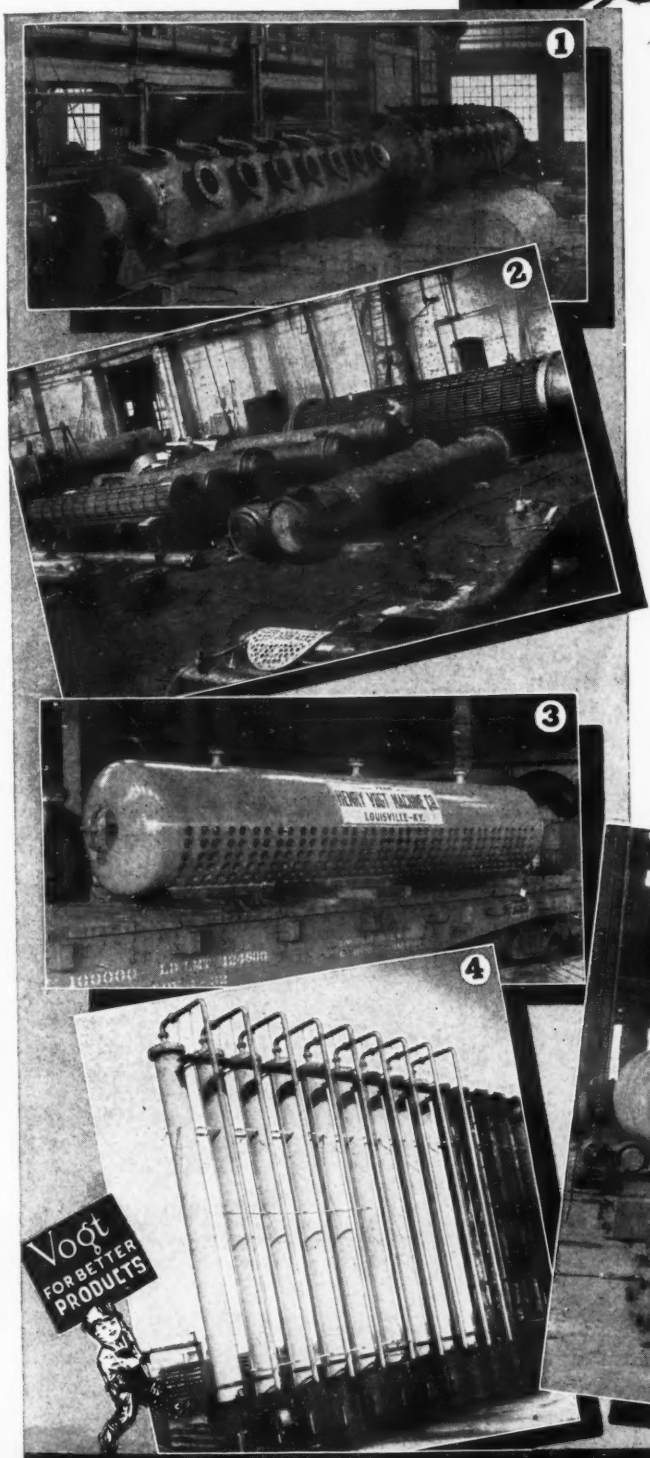
Clark H Pasmore and Roland C Koehler, partners of Koehler-Pasmore, Detroit, have been appointed engineering representatives for state of Michigan by **Associated Research, Inc,** Chicago, Ill. They are assisted by Robert Marshall, George Elliott and Ruth R Koehler.

Jeffrey Co has purchased Case Crane & Kilbourne Jacobs Co. Located adjacent to the Jeffrey plant, it will operate as a subsidiary with no changes in management.

Eutectic Welding Alloys Corp elected John H. Poulson and G Luke Mizell to the board of regional sales supervisors. Poulson

A.P.I.—A.S.M.E. and A.S.M.E. CODES • CARBON STEEL AND SPECIAL STEEL

WELDED PRODUCTS *by* Vogt



1 - 4′—0″ dia. x 7′—6″ dia. x 82′—5″ high Stabilizer Tower for a Texas Refinery. Fabricated to A.P.I.-A.S.M.E. Code, stress relieved and X-rayed. 250# working pressure.

2 - Heat Exchangers, for an Eastern Refinery, on the testing floor. Units have fusion welded Monel Metal shells and were built to customer's specifications.

3 - 48″ dia. x 22′—6″ long mud drum for a Vogt Water Tube Boiler designed to operate at 450# S.W.P. Fusion welded to A.S.M.E. Boiler Code.

4 - Battery of Absorption Columns in a Western Refinery. Units are 33″ dia. x 41′—0″ high and were stress relieved after welding.

5 - 400 KV Industrial X-ray unit in our plate welding department. Exographs of welded seams can be quickly made because of the special motor operated rolls and traveling carriages which are adjustable to vessels of any size.

HENRY VOGT MACHINE CO.

Incorporated

LOUISVILLE, KENTUCKY

BRANCH OFFICES: NEW YORK · PHILADELPHIA · CLEVELAND · CHICAGO · DALLAS

EXTRA POWER IN A SMALL MOTOR

means faster more thorough tube cleaning

AT LESS COST

Size for size, the Wilson ECT Series Air Motor will develop up to 40% more power than ordinary motors. That's why it can deliver maximum power at the most efficient cutter head speeds, *with less air consumption.*

The exclusive six-blade, light-bladed construction of the ECT Air Motor, together with automatic valving of operating air, assure maximum power from every cubic foot of air. 12 powerful impulses per revolution produce smoother flow of power—higher torque at any speed.

All this adds up to tube cleaning economy and lower air consumption. Whether you're cleaning water tubes or fire tubes a Wilson ECT Series Cleaner will mean faster cleaning for less down time, thorough cleaning for production savings.

For detailed information, write to Dept. I

TW-744

THOMAS C. WILSON, INC.
21-11 44th AVE., LONG ISLAND CITY 1, N. Y.
CABLE ADDRESS: "TUBECLEAN," NEW YORK

WILSON
TUBE CLEANERS

will be responsible for field engineers in eastern United States and Canada; Mizell for middle and South Atlantic area of the United States.

Curtis G Green became manager of **Baldwin Locomotive Works'** Chicago district office. He replaces D I Packard, who has resigned.

Monsanto Chemical Co, plastics div, has divided the industrial and surface coating resins dept into two groups. E Everett Decker has been named to head one of the new sales groups, the adhesives and industrial resins dept. Edmund S Bauer Jr has been appointed to assist him. Albert W Dunning remains sales manager of surface coatings resins dept, assisted by William C Davis. The changes are result of transfer of the company's Lockport, N. Y. operation to Springfield, Mass. The Merritt-Monsanto operation, which is a subsidiary of Monsanto, remains in Lockport.

Also, Carl T King, production manager, continues in his present position and is additionally responsible for coordination of activities in Monsanto's foreign plants and for special assignments. Operation of Springfield production dept will be under direction of Robert K Mueller, assistant production manager. Kenneth M. Irey, plant manager, has been named to direct the phenolic plant. William T Dickens, assistant plant manager, has been appointed to handle production of continuous and sheet plant. John C Garrels Jr becomes plant manager of thermoplastic plant. Thomas J. Diviney, director of industrial relations, has been made responsible for coordination of office management activities. Division engineering will be segregated into a divisional engineering dept and dept of plant engineering and services, both under direction of Carl O Hoyer.

Monsanto Chemical Co, western div, has transferred William F Roberts to Los Angeles, Calif. as branch manager in charge of plastics. Robert U Haslanger has been made assistant to general manager of western div, with headquarters at Seattle, Wash. James B Irwin Jr succeeds him in St. Louis. Haslanger will become assistant general manager of this division upon retirement Mar 1, 1949 of H P Banks, present general manager. Banks will be succeeded by I C Smith, current assistant general manager.

E W Chapman was appointed vice-president in charge of engineering for **Tuthill Pump Co,** Chicago.

Crane Packing Co announced removal of Philadelphia office and opening of warehouse facilities of 5 E Montgomery Ave, Bala-Cynwyd, Pa.

Resinous Products and Chemical Co has merged with Rohm & Haas Co, Philadelphia. The following officers have been named: (1) *president*—Otto Haas; (2) *executive vice-president*—Duncan Merriwether; (3) *vice-presidents*—C E Andrews, A L Blount, R A Connor, L W Covert, D S Frederick, E L Helwig, L Klein (4) *secretary*—S C Kelton; (5) *treasurer*—W

TOUGH LAYOUTS

- ✔ Assured Safety
- ✔ Efficient Operation
- ✔ Minimum Fuel Costs
- ✔ Low Maintenance
- ✔ Long, Trouble-Free Life

MADE SIMPLE BY NAVCO

The high degree of skill acquired by Navco Engineers from long experience in solving unusual Piping problems is your guarantee of an accurate and workmanlike Piping System.

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TEMPLETON RETURN STEAM TRAPS

For Pumping, Boiler Feeding, Draining Heating and Vacuum Lines.

Pumps Water at any temperature or pressure.

Valves and Seats of Stainless Steel.

Sizes 1 in. to 4 in. inlet and outlet.

Capacity 2500 lbs. to 60,000 lbs. water discharge per hr.

Send us your problems

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From ¼ to 400 KVA up to 15,000 volts

We manufacture a complete line of:

***AIR, OIL OR WATER-COOLED DISTRIBUTION TRANSFORMERS**

***Special Designs available to meet Customers' Specific Requirements**

TRANSFORMERS FOR

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POWER & LIGHT TRANSFORMERS

For isolation of Light from Power, or Light from Telephone

EISLER TRANSFORMERS are manufactured strictly to Standards of the N.E.M.A., A.S.A., and A.I.E.E.

WRITE FOR SPECIAL CATALOG

EISLER ENGINEERING CO., INC.

Chas. Eisler, Pres.

757 South 13th Street, Newark 3, N. J.

T McClintock; (6) *assistant secretaries*—J F Bergin, P J Clarke, William Kohler; (7) *assistant treasurers*—T V Monahan, George Schnabel. Directors of the company are: Otto Haas, chairman; E C B Kirsopp, vice chairman; William W Bodine; R A Connor; L W Covert; D S Frederick; W J Friedman; F O Haas; John C Haas; S C Kelton; L Klein; Duncan Merriwether.

American District Steam Co, North Tonawanda, N. Y. has established a branch office at 1922 Oliver Bldg, Pittsburgh 22, Pa. under supervision of J A Gustafson.

Dr Lewis Warrington Chubb, director emeritus of **Westinghouse Research Laboratories,** retired after 43 years of scientific research with the company.

Westinghouse Electric Corp appointed E B Bremer electrification manager in the northwestern district.

S R Zimmerman Jr has become director of friction material research and development for **Raybestos-Manhattan, Inc.** In his new capacity Zimmerman will direct the corporation's research and development activities on its friction materials at its plants in Stratford, Conn.; Manheim, Pa.; Passaic, N. J.; and North Charleston, S. C. He will remain at Manheim, Pa.

International Nickel Co, of Canada, Ltd, elected Dr Donald Hamilton McLaughlin as a director of the company. He fills the vacancy on the board caused by death of William Nelson Cromwell.

Forrest E. Allen has joined development and research div of **International Nickel Co.** Allen will make his headquarters at New York and will work on the firm's educational program with universities and colleges in the United States.

American Brake Shoe Co appointed Victor L Persbacker as auditor. In addition to his new duties, he will continue to serve as assistant comptroller.

C P Corrigan was promoted to district sales manager for the Cleveland area of Ramapo Ajax div of **American Brake Shoe,** and William H Starbuck became assistant general sales manager of the Kellogg div. Starbuck is located at the division's offices in Rochester, N. Y.

Ernest W Heyder is now associated with **Fulbright Laboratories,** Charlotte, N. C., as director of research in the chemical and metallurgical div.

General Electric Co has chosen Graybar Electric Co as national distributors for resin and insulation materials div of the firm's chemical dept. Graybar will handle all GE insulating materials except friction and rubber tapes.

Other **GE** changes are as follows: (1) Harold H Watson became commercial engineer of construction materials dept. (2) George E Wickman was made manager of sales for the same dept. (3) Ralph C Dean

THERE'S STILL TIME TO MODERNIZE YOUR BOILER PLANT

WITH

TODD BURNERS

You *can* replace obsolete equipment with Todd Burners and be ready for winter. The capacity of the Todd organization . . . world-wide distributors and facilities . . . standardized equipment . . . are your assurance of economy and efficiency in the burning of liquid and gaseous fuels. Take advantage of the long experience and "know how" of Todd engineers.

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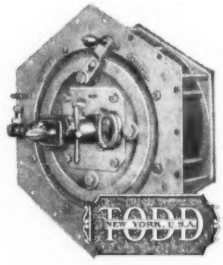
Gas Burners

Combination Oil and Gas Burners



COMBUSTION EQUIPMENT DIVISION

TODD SHIPYARDS CORPORATION

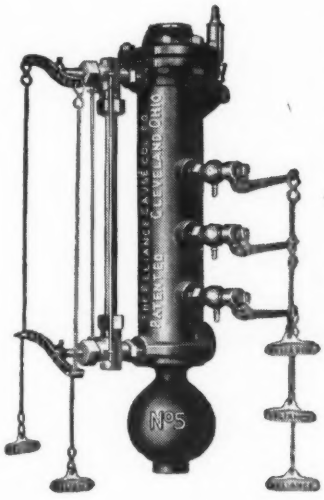
81-16 45th Ave., Elmhurst, Queens, N. Y.

NEW YORK • BROOKLYN • ROCHESTER BUFFALO • HOBOKEN • NEWARK • PHILADELPHIA HARRISBURG • YORK • CHICAGO • CHARLESTON, S. C. • BOSTON • SPRINGFIELD, MASS. BALTIMORE • WASHINGTON • RICHMOND, VA. ATLANTA • DETROIT • GRAND RAPIDS • TAMPA GALVESTON • HOUSTON • MOBILE • NEW ORLEANS • LOS ANGELES • SAN FRANCISCO SEATTLE • MONTREAL • TORONTO BARRANQUILLA • BUENOS AIRES • LONDON

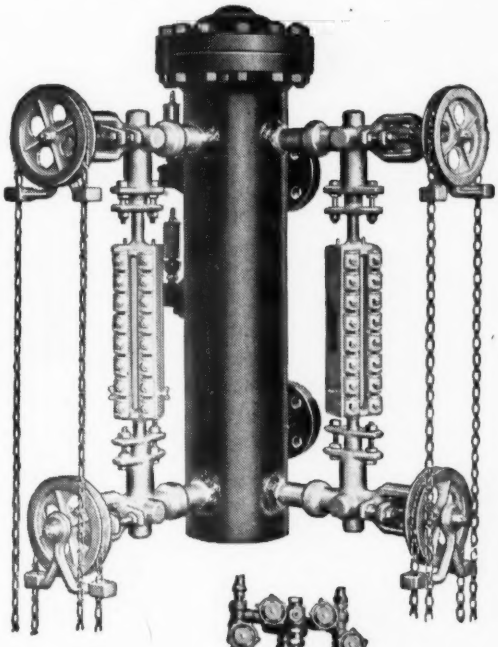
Reliance ...Your source of complete supply for *Basic* BOILER SAFETY EQUIPMENT

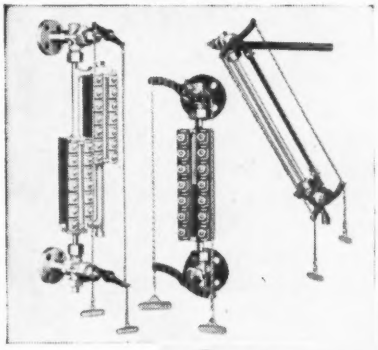
First Choice of Boiler makers and Consulting engineers

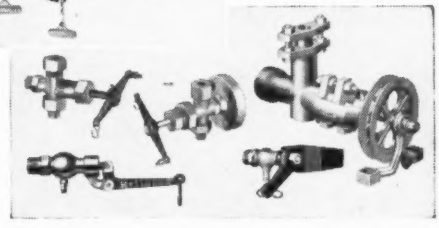
Water Columns and Gages are *basic* equipment you *must add* to your boiler when installed, or order with it from your boiler maker. Reliance offers you the most complete service in approved devices for water level supervision — always in tune with latest developments and techniques in power production. Known the world over for accuracy, sturdiness and dependability, there's a Reliance Water Column for every type of boiler — any pressure — and gage equipment for every water level checking need:

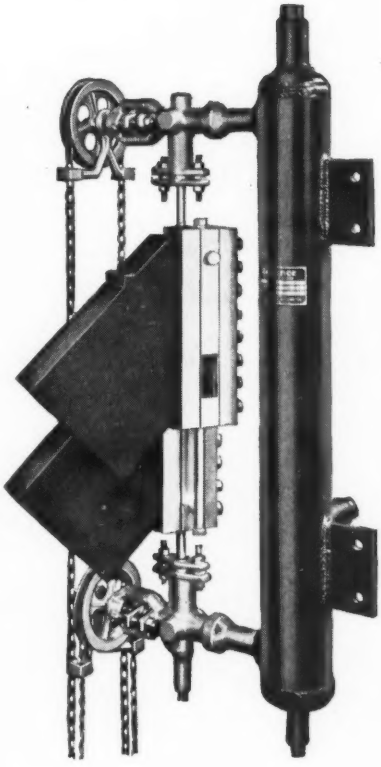


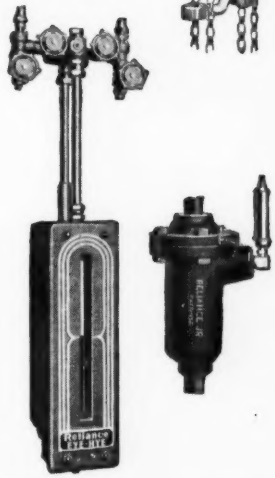
- High and low Alarm Water Columns
- Water Columns without alarm
- EYE-HYE Remote Reading Water Level Indicator
- EYE-HYE with graduated face plate for tanks & vessels
- EYE-HYE for unusually wide liquid level variations
- Gage Valves
- Gage (try) Cocks
- Junior Water Level Alarms
- Prismatic Water Gage Insert
- Mica-protected Flat Glass Insert
- Micasight Safety Water Gage Insert
- Water Gage Illuminating Equipment











Representatives in all principal cities, or write the factory for catalogs and information.

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Reliance

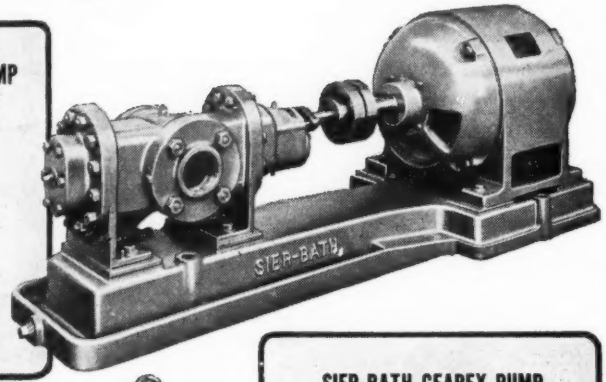
THE RELIANCE GAUGE COLUMN CO. · 5902 CARNEGIE AVENUE · CLEVELAND 3, OHIO

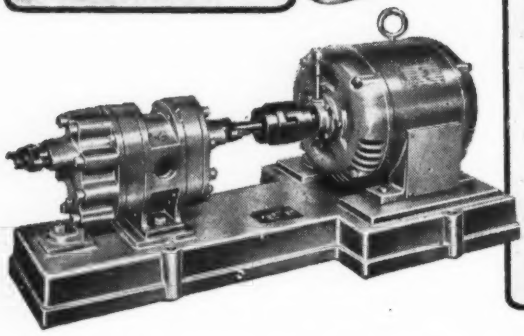
ONE PUMP working on the job is *worth a dozen* in the repair shop!

SIER-BATH SCREW PUMP

Advantages: • pulseless flow • anti-friction bearings • vibrationless operation • low maintenance cost • rugged construction.

Pumps: Acetate, asphalts, brines, Bunker C Fuel Oil, Cellulosics, Greases, Molasses, Syrups, Lube Oils, etc.





SIER-BATH GEAREX PUMP

• Balanced Axial Thrust • Pulseless Flow • Vibrationless Operation • Roller Bushings for Precision Running under load.

Pumps: Oils, Varnishes, Solvents, Molasses, Chemical Solutions.

Capacities: 1-550 g. p. m.

Discharge: 250 p. s. i. for medium or high viscosities. 50 p. s. i. for water.

The most notable point about SIER-BATH Screw Pumps and Gearex Pumps is their relative freedom from maintenance.

THERE is no mystery about the ability of Sier-Bath Pumps to stand up under the most trying conditions. After all, in such pumps, the worms and gears are the most important parts. And when you consider that Sier-Bath Pumps are made in the best equipped precision gear shop in the country, it is easy to understand their exceptional dependability. Their pulseless flow and vibrationless operation greatly reduce maintenance cost—there is much less wear on valves, couplings and other fittings. Pipes and joints remain tight. With labor costs at their present high figures, these are important points to consider in pump selection. Send for descriptive booklet.

ALSO MAKERS OF SIER-BATH PRECISION GEARS

FOUNDED 1905 **MEMBER A. G. M. A.**

Sier-Bath
GEAR and PUMP CO., Inc.

9524 HUDSON BOULEVARD • NORTH BERGEN, NEW JERSEY

succeeded Wickman as manager of construction materials sales in the north central district, Chicago. (4) Frank T Lewis has been named manager of manufacturing in aeronautic and ordnance systems divisions. (5) A H Graham now manages the dc armored-motor engineering div, small and medium motor divisions, Erie Works.

Foxboro Co, Foxboro, Mass. moved its branch office in Houston, Texas to 2518 South Boulevard. Leo W Parten continues as district manager.

Carborundum Co, Niagara Falls, N. Y., announces following personnel changes: E B Forse was appointed assistant vice-president. E R Baxter became director of sales and sales administration succeeding C E Hawke, who assumed responsibilities as manager of refractories div at Perth Amboy, N. J. G R Rayner, Jr is assistant director of sales administration under Baxter.

Hamilton-Thomas Corp, Hamilton, Ohio has been formed to operate Economy Pumps, Inc, Klipfel Manufacturing Co and Liberty Planers, Inc. Officers of the corporation are: (1) Richard Thomas, president (2) L G Thomas, executive vice-president (3) H R Ryan, vice-president (4) R H Thomas Jr, vice-president (5) E T Drinkuth, secretary (6) L V Thomas, treasurer.

Marshall G Munce has been elected a vice-president of **York Corp,** York, Pa. He will represent top management in assisting and supporting the sales organization through trade relations and public relations activities. J Keith Louden has taken over his job as coordinator between engineering, manufacturing and sales divisions.

George W Perry is the new advertising manager of **Cook Electric Co,** Chicago.

Mutual Boiler Insurance Co, Boston, opened a sales and inspection office at 141 Carnegie Way NW, Atlanta, Ga. in charge of E L Gates Jr. Inspections are under direction of W C Lange. An inspection office at 17 Exchange St, Providence, R. I. was also opened. Jack Groves directs inspections there.

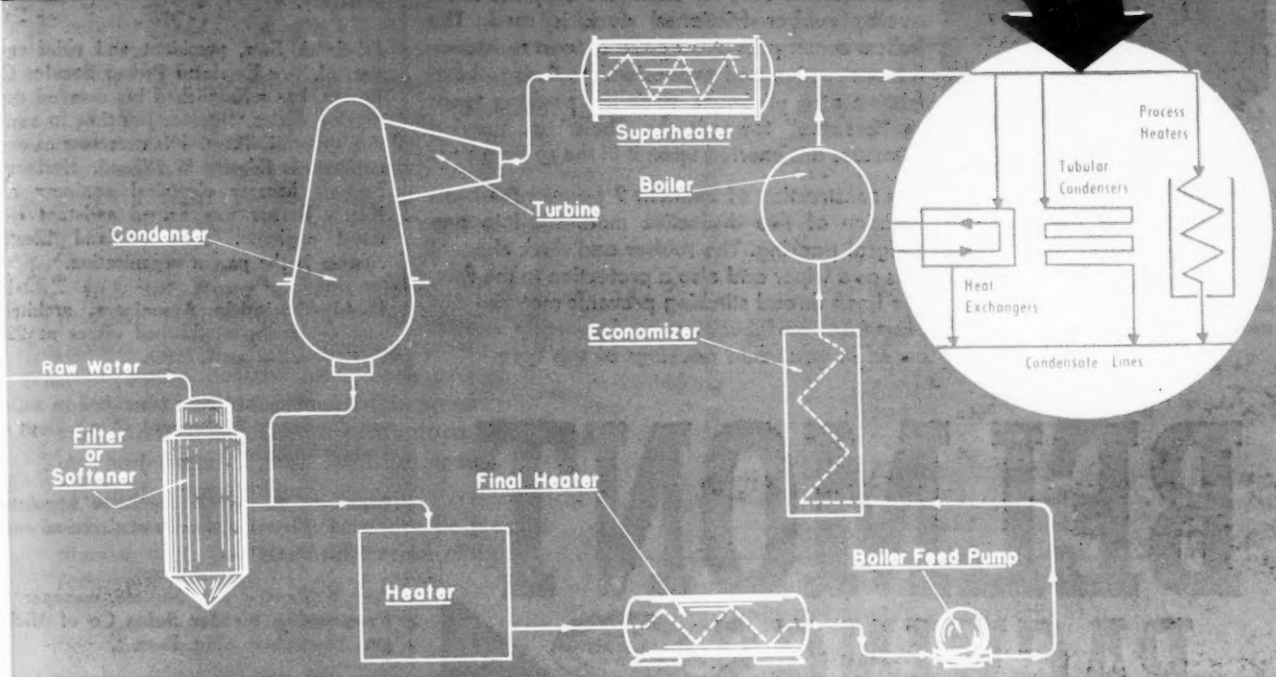
Clarence S Cole is now assistant general superintendent of **Niagara Falls Power Co.** He succeeded Charles A Clancy, who had been named general manager of the company's subsidiary, Canadian Niagara Power Co, Ltd, Niagara Falls, Ont. Daniel W Brown has been made superintendent of electrical and mechanical maintenance and Henry E Hird became chief electrician.

Central Electric and Gas Co, Lincoln, Neb., elected Judson Large president. He replaces Max McGraw, who was named chairman of the board. R A Phillips was re-elected vice-president and general manager of the company and president of its subsidiaries. J B Gallagher was also re-elected vice-president. Harold A Hanson was elected secretary and treasurer.

E B Ricketts, recently retired from Consolidated Edison Co, has become associated with **Wearn, Vreeland, Carlson &**

IS YOUR PLANT OPERATION SUFFERING FROM WATER TREATMENT PROBLEMS...

IN PROCESS EQUIPMENT?



Serious production delays and high maintenance costs can result from corrosion and/or deposits occurring either in the steam condensate cycle or in the cooling water cycle of process equipment.

STEAM CONDENSATE CYCLE—Because pure water is involved, the chief difficulty encountered is corrosion, which is usually caused by a low pH condition resulting from the presence of carbon dioxide. Deposits sometimes form because of carryover or from the adherence of corrosion products. In some instances, the steam and condensate may come in direct contact with materials in process, in which case high steam purity is essential.

COOLING WATER CYCLE—Deposits are caused largely by the breakdown of carbonate hardness as the water is heated and/or concentrated. The systems involved range from simple once-through types to complex closed systems involving cooling towers and related equipment.

In order to eliminate these problems, proper water treatment must be instituted. This may range from the use of a volatile alkaline corrosion inhibitor in the steam and condensate cycle to the use of specific anti-precipitating agents and sludge conditioners in the cooling water cycle. Where steam purity is a consideration, proper boiler water treatment is necessary.

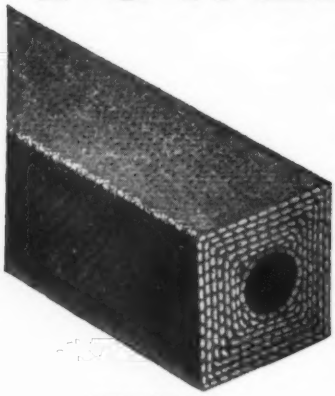
Some of these difficulties are probably present in your plant. They require intelligent diagnosis and recommendations for corrective measures. Your local Drew engineer will be glad to call and discuss any phases of water treatment without obligation.

POWER DREW CHEMICALS

E.F.DREW & CO. INC.
15 E. 26th ST., NEW YORK 10, N. Y.
Representatives in all key cities

BOILER WATER TREATMENT
COOLING WATER CONDITIONING

MORE POWER TO YOU!



BELMONT 319
Hollow Center Packing

For low and intermediate steam; hot and cold water rods and plungers; steam hammers and elevator plungers.

Philadelphia, Pa. No matter how small — power leaks are costly. That's why Belmont takes such minute care in the construction of all Belmont Packings.

Take Belmont 319, for example. Only the finest quality rubber frictioned duck is used. The hollow center provides a point of least resistance for contraction and expansion. It serves to keep friction at a minimum, since the packing tends to "breathe" towards the "hole" as varying pressures are exerted upon it in the stuffing box.

The construction of Belmont 9 permits the combination of two distinctive materials into one integral packing. The rubber and duck channel acts as a wiper and also a protection to the flax. The linen thread stitching prevents material displacement and buckling so frequently experienced in unstitched packings of this type

BELMONT PACKINGS

Belmont Advertising works for every BELMONT DISTRIBUTOR. It is designed to create better Buyer-Distributor relationship. Each and every sales message instructs the reader to consult the local Belmont Distributor when Packings are required.

Belmont Advertising appears in Power, Operating Engineer, Power Generation, Industry & Power, Southern Power & Industry, Mill & Factory and leading catalogs.

Belmont Advertising creates demand for Belmont Packings by promoting the extra values in the Belmont line.

It develops definite sales leads and directs the reader to the BELMONT DISTRIBUTOR.

BELMONT 9
Special Hydraulic Channel Flax

For all hydraulic services from low pressure to extreme heavy duty, hot and cold water.

THERE'S A BELMONT PACKING FOR EVERY SERVICE

Steam, Water, Oil, Gas, Air, Acids, Ammonia

Rings, Spirals, Coils, Reels, Spools, Sheets, Gaskets.

THE BELMONT PACKING & RUBBER COMPANY
BUTTONWOOD AND SERVIVA STREETS • PHILADELPHIA 37, PA.

Sweatt, Inc, of New York City, as a consultant on power-plant design. He will be available for consultation on power-plant problems. Ricketts had been with Consolidated Edison Co for the past 40 years, and for the last ten years was mechanical engineer in charge of mechanical and structural power-plant design.

Central Vermont Public Service Corp announced the following changes in officer personnel: Glover W Rogers was elected treasurer; Horace J Lyne, auditor. Prescott H Wellman, formerly secretary and treasurer, resigned from treasurer's duties for reasons of health but will continue as secretary.

Edwin A Dow, president and chief engineer of **New England Power Service Co,** Boston, has relinquished his detailed engineering duties to devote full time to executive responsibilities. His successor as chief engineer is Edward W Dillard. Herbert R Stewart became electrical engineer and Harris Barber was named assistant electrical engineer. New England Electric System is the parent organization.

Boddy-Benjamin Associates, architects and engineers, established offices at 2210 Park Ave, Detroit 1, Mich.

H E Lordley has been promoted to assistant director of **Richmond (Va.) Dept of Public Utilities.**

Stanford Research Institute appointed Thomas Morrin chairman of electrical engineering research.

Roy S Rankin has become manager of **Progressive Welder Sales Co** of Michigan, Maccabees Bldg, Detroit.

The advertising agency formerly known as G P Blackiston changed its name to **McNevin-Wilson-Dalldorf, Inc,** with offices at 55 W 42nd St, New York 18, N. Y. Members of the new organization are as follows: *president*—John J McNevin; *secretary*—John Wilson. Charles J Dalldorf continues in his present capacity with title of vice-president. E Ryan is in charge of office and agency routine.

Perry Knight and James A Perry, two members of **Georgia Public Service Commission,** won re-election in the state primary.

National Bureau of Standards has given Howard S Bean added responsibilities as chief of the newly formed capacity, density, and fluid meter section. The consolidation of gas measuring instrument and the capacity and density groups formed the new section.

Stanton E Winston, dean of the evening division and professor of mechanical engineering at Illinois Institute of Technology, resigned as director of the annual **Midwest Power Conference.** Roland A Budenholzer, professor of mechanical engineering at Illinois Tech, replaces him. E R Whitehead, director of dept of electrical engineering at Illinois Tech, continues as conference secretary.

INGERSOLL-RAND BOILER-FEED PUMPS *for really* HIGH *pressures*

Each installation of high-pressure boiler-feed pumps is a specialized job. Factors such as plant layout, load factor, feedwater treatment, boiler pressure, etc., play an important part in the design of the boiler-feed pump and the materials used in its construction.

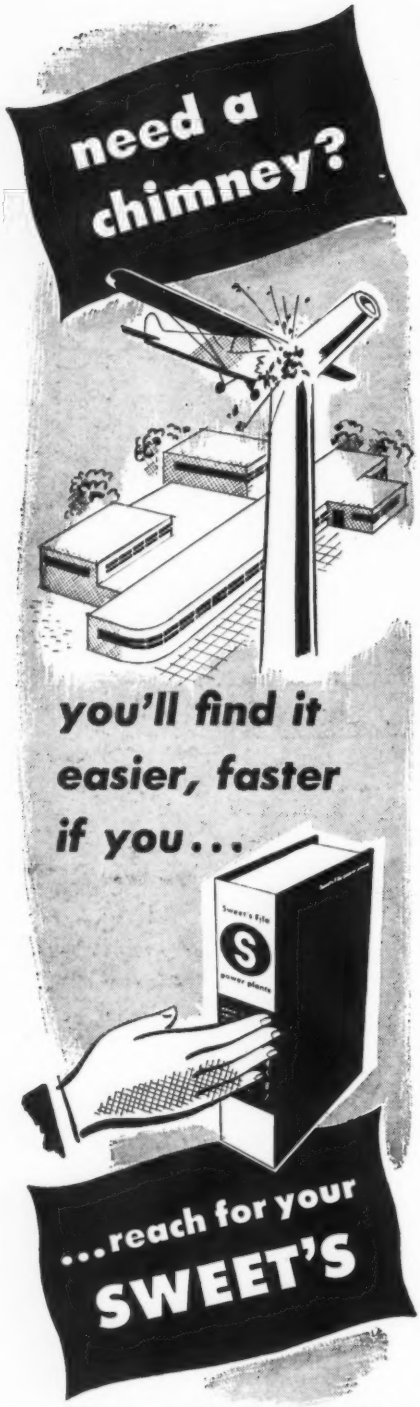
Ingersoll-Rand is eminently equipped to produce really high-pressure boiler-feed pumps for the most exacting service. I-R basic pump designs have been proven on many of the outstanding high-pressure installations. Unexcelled manufacturing, testing and metallurgical facilities insure dependable construction.

Ingersoll-Rand engineers will be glad to discuss with you the application of boiler-feed pumps to any type of plant.

Ingersoll-Rand High-Pressure Boiler-Feed Pump Installations above 1700 psi

Installation	Pump Discharge Pressure	Years in Service
A	2900	8
B	2180	7
C	1894	2
D	1890	8
E	1850	8
F	1850	8
G	1850	8
H	1830	8
I	1800	11
J	1800	7
K	1750	11
L	1750	11
M	1750	8
N	1745	2
O	1745	2
P	1720	9
Q	1720	8
R	1700	7

Many additional units in this pressure range are now in production.



When you need specific information on materials or equipment, reach for your Sweet's File for Power Plants (the big red file). It contains 119 manufacturers' catalogs full of useful information on thousands of products...from absorbers—gas, to zeolite. Cross indexing speeds finding.

If Sweet's File for Power Plants is not available in your office, make request immediately for application form. Files are distributed FREE to those qualified.

Sweet's

CATALOG SERVICE

for easier, faster selection of products

119 W. 40th ST., NEW YORK 18, N. Y.

OBITUARIES

Aldus C Higgins, 75, chairman of executive committee, Norton Co, Worcester, Mass. died Sept 10 at his home in that city. He was also chairman of the board of Riley Stoker Corp.

Eugene Hahn, 60, vice-president and general manager, Hahn-Pitz Corp, Brooklyn, N. Y. died suddenly on Sept 20 following a heart attack.

Carroll D Hepler, 43, general manager of construction materials dept, General Electric Co, Bridgeport, Conn. died of a cerebral hemorrhage during a visit to GE factory at New Kensington, Pa. on Sept. 22.

George Clark Gillies, president, Belmont Packing and Rubber Co, Philadelphia, Pa. died Sept. 8.

Emil R Gasser, 44, director of research of Farrel-Birmingham Co, died suddenly Sept 5 at his home in Buffalo, N. Y.

Raymond E Palmer, 57, company engineer and project manager at Mexico City plant of U. S. Rubber Export Co, Ltd, died Aug 26 in Mexico City.

Walter C Winkel, 59, president of Modine Mfg Co, Racine, Wis. died Aug 22. He had been a director of the firm for 25 years.

Howard Butt, 58, vice-president and manager of New York office of Wm Powell Co, died Aug 23 at his home, Side Hill, Morristown, N. J.

Arthur Perry Peterson, president and founder of Control Corp, Minneapolis, Minn. died July 16 from a cerebral hemorrhage.

William W Spellman, 61, stationary engineer for Linde-Air Corp, Utica, N. Y. died Sept 5 after a two months' illness. He had been with the company 32 years.

Peter Schreck, 81, stationary engineer for the former Warnick & Brown Co, Utica, N. Y. for 30 years, died Sept 3 after a long illness. He retired in 1946.

Edward L Perry, stationary engineer at Erie Forge Co, Erie, Pa., died Aug 24 in an Erie hospital.

William H Matthies, 39, engineering supervisor in charge of maintenance and power at DuPont chemical plant, Dresden, N. Y., died in an automobile accident recently.

John A Darling, 67, widely known electrical operating executive of Boston Edison Co, died Aug 27 in Boston.

Isaac J Marcuse, 80, a director and officer of Hydro-Electric Corp of Virginia, died recently at his summer home in Wake, Middlesex County. He was also owner of a dam and power site at Snowden, on the James River, above Lynchburg, Va.

FOR FULLY AUTOMATIC CONTROL OF ALL WATER TREATMENT PROCESSES

EXPERIENCE COUNTS

• Panel designed for fully automatic control of Belco Softener, Alkalinity Remover and Deaerator in large process industry.

• Eleven alternate process cycles are precision controlled with this unit.

Belco engineers are thoroughly experienced in all phases of completely automatic water treatments. By applying this wide experience to your processes you can avoid the losses that result from outdated control—you can reap the savings that result from modern simplified automatic Belco control. Experience counts . . . Belco has, for example, the advantage gained through designing and building the worlds largest fully automatic demineralization and silica removal plant.

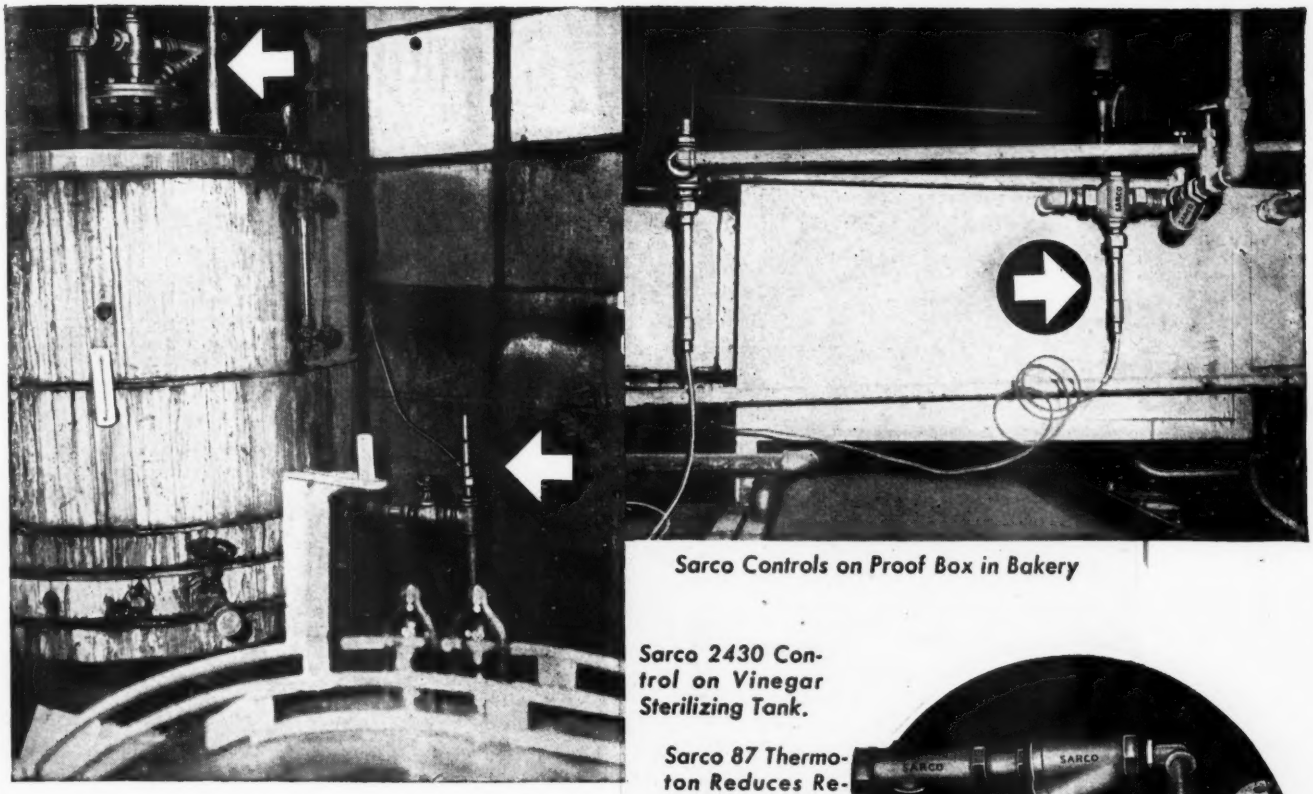
MODERNIZATION OF EXISTING PLANTS RESULTS IN LARGE OPERATING SAVINGS

Ask a Belco engineer how modernization might effect substantial savings in your present operations. Ask about the application of the Belco automatic controls to other processes in your plants.

BELCO INDUSTRIAL EQUIPMENT DIVISION, INC.
50 Iowa Avenue Paterson 3, N. J.
In midwest: Deady Chemical Co., Kansas City, Mo.
In southwest: Watermasters, Inc., Houston, Tex.
In Pacific: Deady Chemical Co., Los Angeles, Cal.

Belco

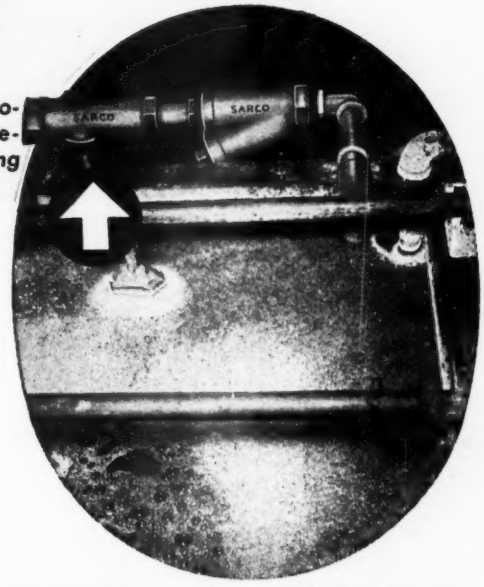
PROCESSES FOR REMOVAL OF WATER IMPURITIES



Sarco Controls on Proof Box in Bakery

Sarco 2430 Control on Vinegar Sterilizing Tank.

Sarco 87 Thermoton Reduces Rejects in Tin Plating Tank.



How Sarco REDUCES REJECTS . . .

Process heat is often applied toward the end of the production cycle. A rejected product at this point means lost materials, lost labor, and lost production—all gone forever with no salvage, as a rule.

Many hours of work are represented in the contents of the 1000 gallon per hour vinegar pasteurizer illustrated. Yet, with hand control the vinegar could scorch in a few minutes—or crack the jugs, and it did frequently.

In another part of this plant, old vinegar jugs are caustic-washed previous to being filled with commercial cleaning solution. Two out of six jugs were cracked with hand temperature control. Now all temperatures are controlled with Sarco—all products uniform, day in and day out, and spoilage is negligible.

Other Sarco controls are daily reducing the percentage of rejects in plating, baking (temperature and humidity controls) syrups and a hundred other chemical and food applications, and Sarco Steam Traps are reducing rejects in many industries by keeping heat up in every part of the coils.

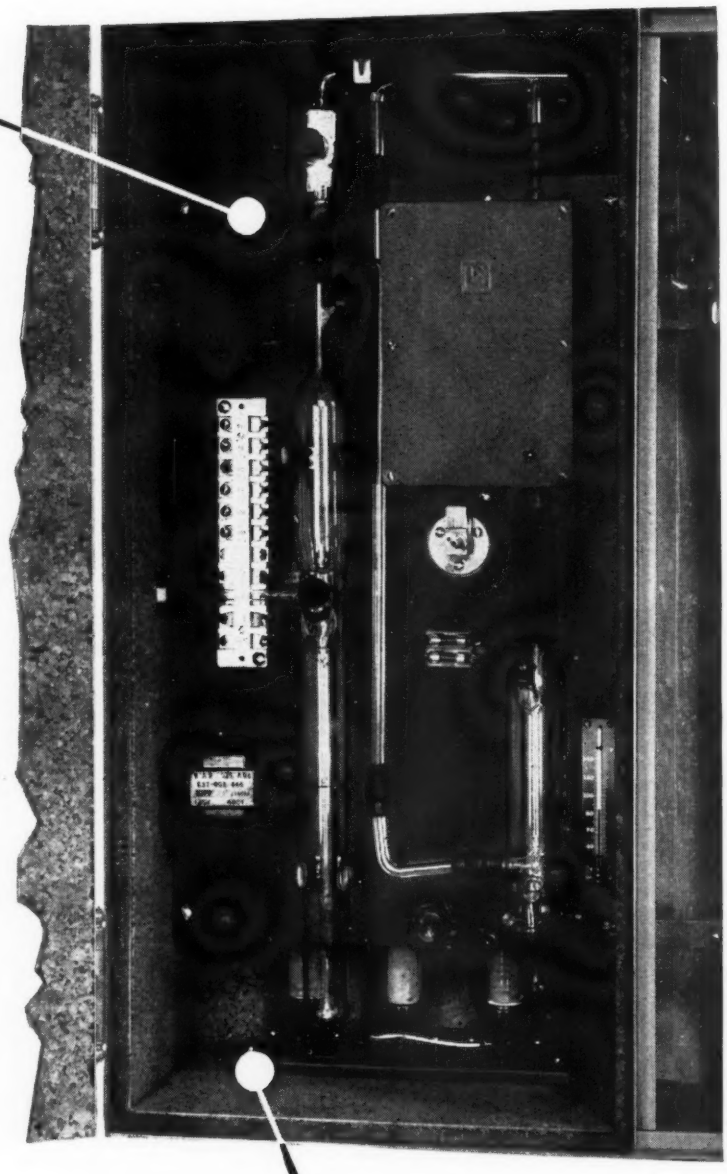
231

SARCO
SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 5, ONTARIO

"Backing up" MICROMAX CO_2 Recording Equipment

(Photograph courtesy of Leeds & Northrup Co.)



K&M EBONIZED ASBESTOS

Electrical Mounting Material

The Micromax CO_2 Equipment for flue gas analysis manufactured by Leeds & Northrup Company . . . is a precision industrial unit that accurately detects and records per cent carbon dioxide . . . enabling combustion efficiency to be held at a high level. For added safety and efficiency the components of the CO_2 analysis cell are mounted on K&M Ebonized Asbestos.

More and more engineers are specifying K&M Ebonized Asbestos dielectric mounting material . . . and here are *six reasons why:*

1. Unusually strong—both dielectrically and mechanically.
2. Highly resistant to shock, vibration, temperature changes.
3. Uniform density throughout.
4. Easy to machine, cut, drill and handle.
5. Versatile in use—supplied in various thicknesses up to 4".
6. Neat, efficient appearance in finished units.

Ebonized Asbestos is a tough, dense sheet of moulded asbestos fibers, Portland cement and an insulating compound. It meets the technical requirements of Underwriters' Laboratories . . . and will satisfy your requirements in switchboards, bus bar runs, compartment linings, testing tables, bench boards. Write us for more details.

Nature made Asbestos . . .

Keasbey & Mattison has made it serve mankind since 1873

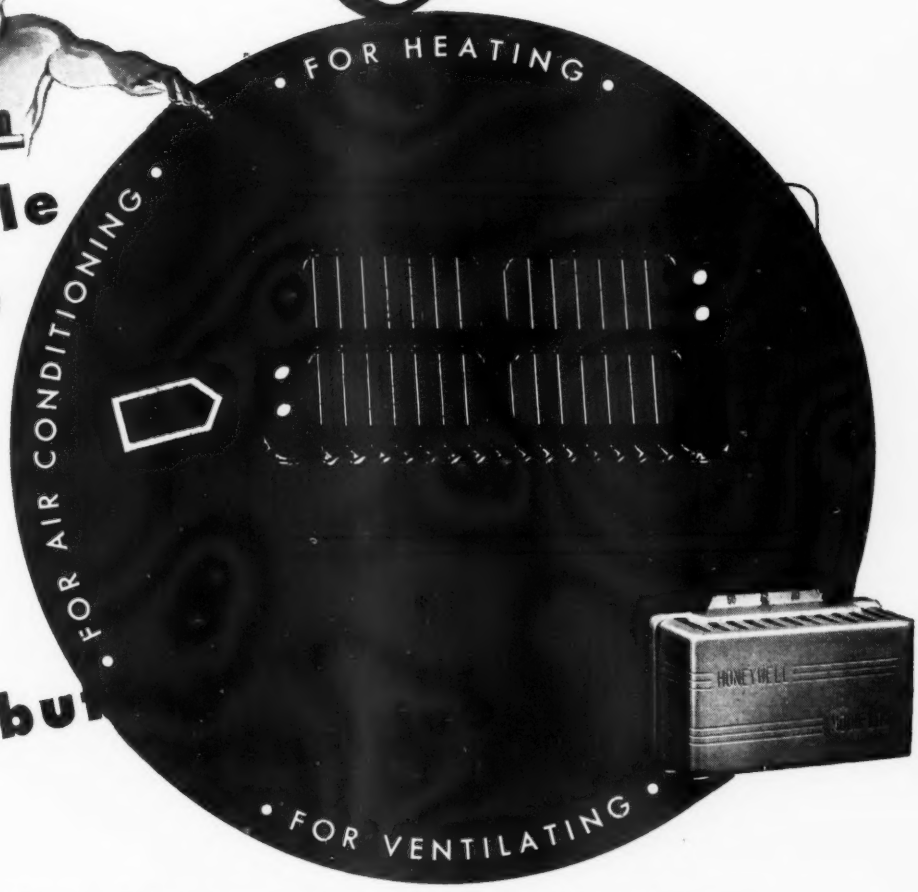
KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

IN CANADA—ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG AND VANCOUVER

DIAMOND ANNIVERSARY 1873 1948 K&M Best in Asbestos KEASBEY & MATTISON CO.

HONEYWELL Electronic Control

just a simple coil of wire



...but

THE MAGIC of electronics now brings a new type of automatic control *100 times* more sensitive than existing controls for heating, ventilating and air conditioning. This new standard of precision control also brings extreme simplicity with added flexibility.

The Honeywell Electronic thermostat is a simple coil of wire with no moving parts—nothing to wear out. But see how other factors are simplified! Basic circuits are the same for all types of applications. Fewer control units are needed. Single thermostats, for example, can be used for both heating and cooling with automatic change-over from one to the other at any selected temperature level.

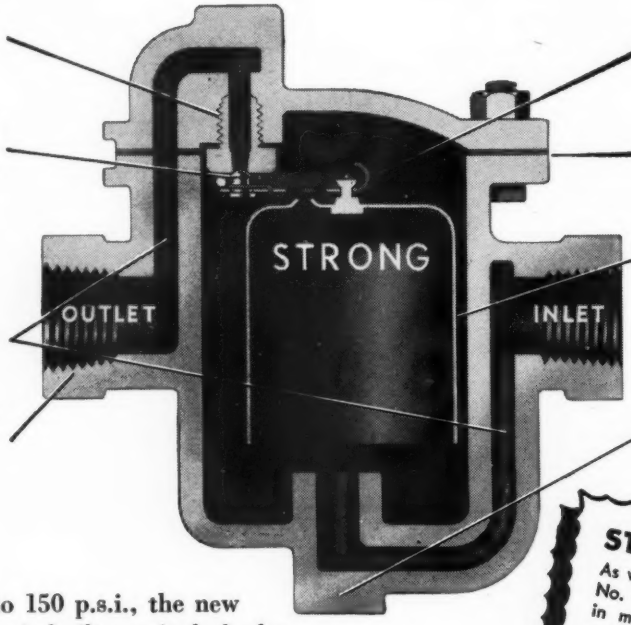
It means a simple, practical answer for many problems to which, until now, there has been no clear-cut solution. So watch Honeywell Electronic Control carefully. It's opening the way for new horizons in the industry. Minneapolis-Honeywell, Minneapolis 8, Minnesota. In Canada: Leaside, Toronto 17, Ontario.

MINNEAPOLIS **Honeywell** CONTROL SYSTEMS

73 BRANCHES FROM COAST TO COAST WITH SUBSIDIARY COMPANIES IN: TORONTO • LONDON • STOCKHOLM • AMSTERDAM • BRUSSELS • ZURICH • MEXICO CITY

At last...

A SMALL TRAP with all these BIG TRAP QUALITY FEATURES!


Renewable seat—easily removed for servicing.
Strong's patented, wear-resistant Anum-Metl* valve and seat—guaranteed leakproof for one year. Scientifically designed Hi-Cap* orifice gives greater capacity.
Oversized ports—increased flow capacity.
Horizontal inline connections — simplify piping.
Stainless 18-8 high ratio leverage.
Large gasket area.
Seamless, deep-drawn, stainless 18-8 bucket —no welds.
Boss provided for drain connection.
STRONG
OUTLET
INLET

Available for pressures to 150 p.s.i., the new Strong No. 070 Steam Trap is built particularly for small drainage jobs where condensate loads are light, yet where conditions call for the well-known economy of a rugged bucket trap.

Strong's 40 years' experience and rigid field tests have been fully utilized in the development of this fine small trap. It embodies all the quality features of Strong's larger traps, making it your best small trap value.

*T.M. Reg., U.S. Pat. Off.

STRONG GUARANTEE

As with all Strong Semi-Steel Traps, the No. 070 is guaranteed against defect in material and workmanship for one year. Strong's patented, wear-resistant Anum-Metl valves and seats are guaranteed leakproof for one year.

Look at these applications— this trap is especially built for them:

LAUNDRIES—Pressing Machines and Ironers, Tumblers, Dry Room Coils, Starchers, Vacuum Stills, Steam Supply Header

INDUSTRY—Unit Heaters (up to 150,000 btu), Pipe Coils, Tire Recap Equipment . . . *wherever small drainage is a problem*

HOTELS, RESTAURANTS—Coffee Urns, Steam Tables, Kettles

HOSPITALS—Sterilizers, Autoclaves

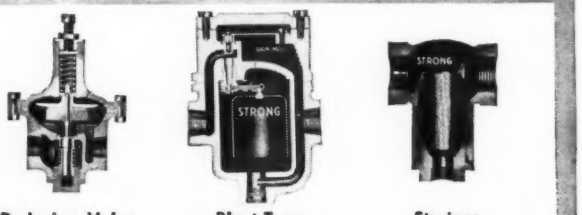
And many more — write today for complete information!

STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3rd Street, Cleveland 13, Ohio

REG. TRADE MARK

OTHER STRONG STEAM SPECIALTIES

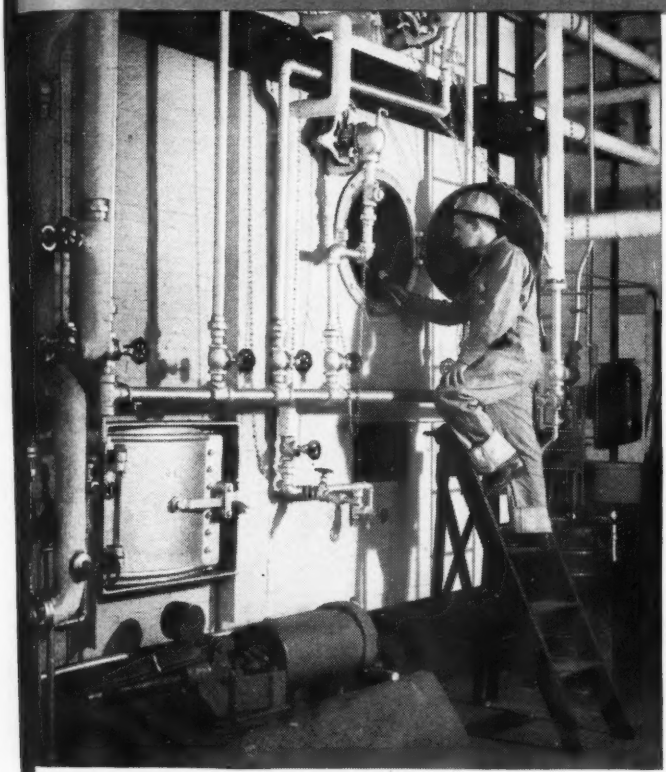
ANUM-METL Reg. Trade Mark



Reducing Valve | Blast Trap | Strainer

DOWELL

SPECIALISTS IN SCALE AND SLUDGE REMOVAL WITH CHEMICALS



Dowell engineer checking boiler temperature with a pyrometer during chemical cleaning.

RESTORE LOST POWER...

with Economical and Convenient Dowell Chemical Cleaning Service

THE DOWELL *service* method of removing scale and sludge from heat exchange equipment has become a regular part of the maintenance program in many industrial plants. Operators have found that giving their cleaning problems to *experienced* Dowell engineers has resulted in the fast, convenient restoration of efficiency and lost power.

The unit to be cleaned is filled with liquid chemical solvents, selected for the particular job and designed to clean away scale and sludge even in the hard-to-reach places, wherever water and steam flow.

Dowell Chemical Scale Removal Service has a place in your plant. Skilled engineers, specially designed pumping and control equipment, tested solvents and proved processes have stepped up cleanliness standards to new highs. Here is a modern answer to power and maintenance engineers' demands for rapid, convenient, economical cleaning. Ask the office nearest you for a free cost estimate.

DOWELL INCORPORATED · TULSA 3, OKLAHOMA

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

CALL

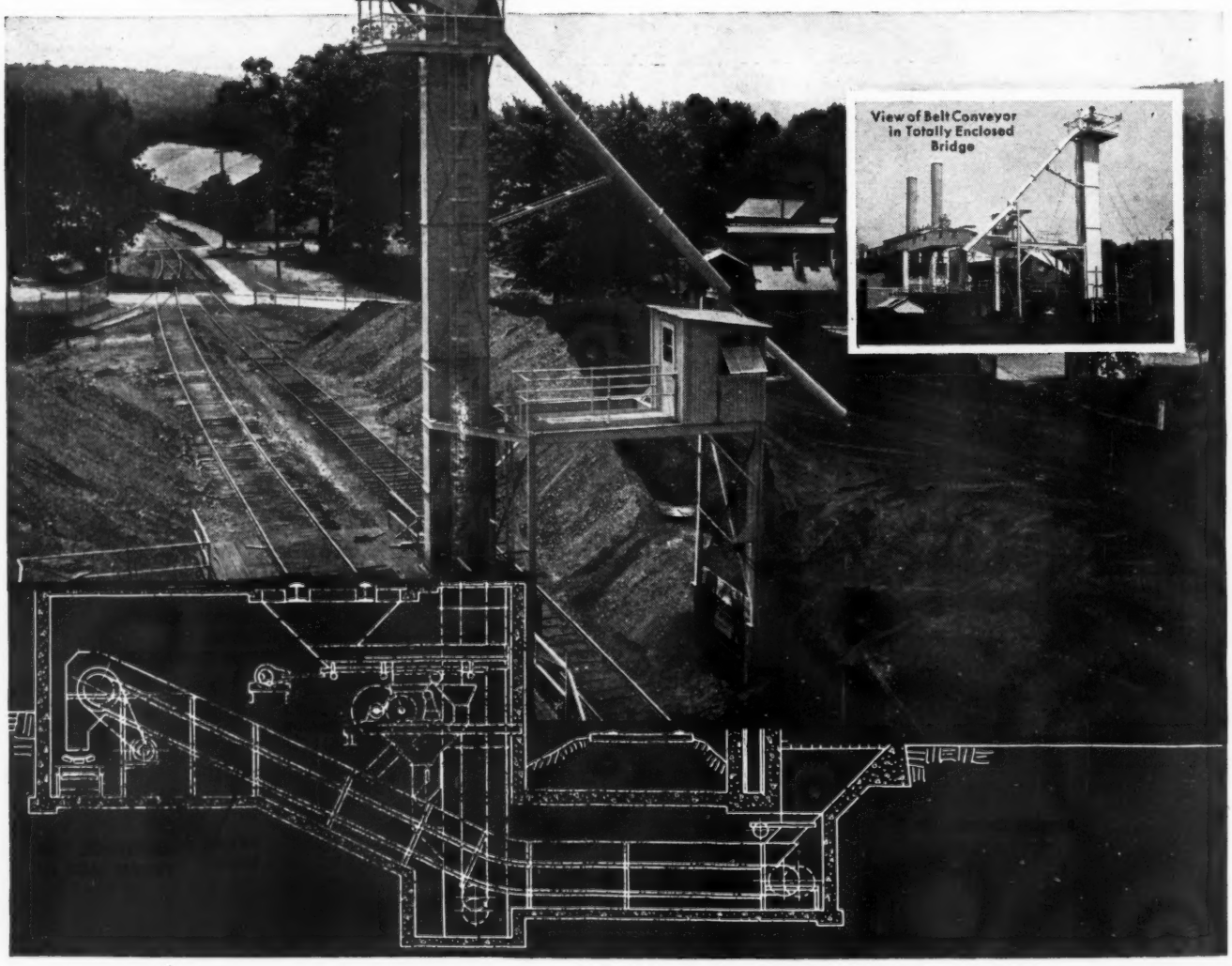
New York 20	Buffalo 2	Kansas City 8	Mt. Pleasant, Mich.
Boston 16	Cleveland 13	Wichita 2	Hamilton, Ohio
Philadelphia 2	Pittsburgh 19	Oklahoma City 2	Charleston 27, W. Va.
Baltimore 18	Detroit 2	Houston 2	Salem, Illinois
Wilmington 99	Chicago 2	New Orleans 12	Borger, Texas
Richmond 19	St. Louis 8	Ft. Worth 2	Midland, Texas
Jacksonville	Indianapolis	Shreveport 23	Wichita Falls, Texas
Atlanta	Louisville	Anniston, Alabama	Lafayette, La.

Long Beach, Oakland, Casper: Dowell Associate-International Cementers, Inc.

DOWELL

A SERVICE ORGANIZATION

went *Underground* to *Overcome* this handling problem



More steam power for peak production at the Picatinny Arsenal, Dover, N. J., called for more coal—more in reserve, more flexible equipment for handling it.

Problem was how best to augment existing facilities to meet this greater demand. A Gifford-Wood engineer looked over the ground—recommended the versatile handling system shown. It provides tremendous reserve storage in addition to bunker storage.

Note how new G-W system can take coal directly from track hopper—(1) through crusher to apron feeder, then by belt conveyor to boiler house bunker, or—(2) by bucket elevator and swivel chute to ground storage. Coal is reclaimed by drag scraper from ground storage and conveyed to bunker by use of the *same* system.

But this is only one of scores of instances where G-W took over the complete job—design, construction and erection . . . shouldered all responsibility. For G-W materials handling experience dates back 140 years . . . definite assurance that consultation with a Gifford-Wood engineer can help *you* solve *your* coal handling problems.

G-W HANDLES IT . . .
faster • easier • cheaper
SINCE 1814

GIFFORD-WOOD CO. 5220

NEW YORK 17
420 LEXINGTON AVENUE

Factory:
Hudson, N. Y.

CHICAGO 6
565 W. WASHINGTON ST.

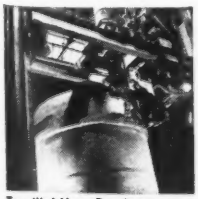
Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.

Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.

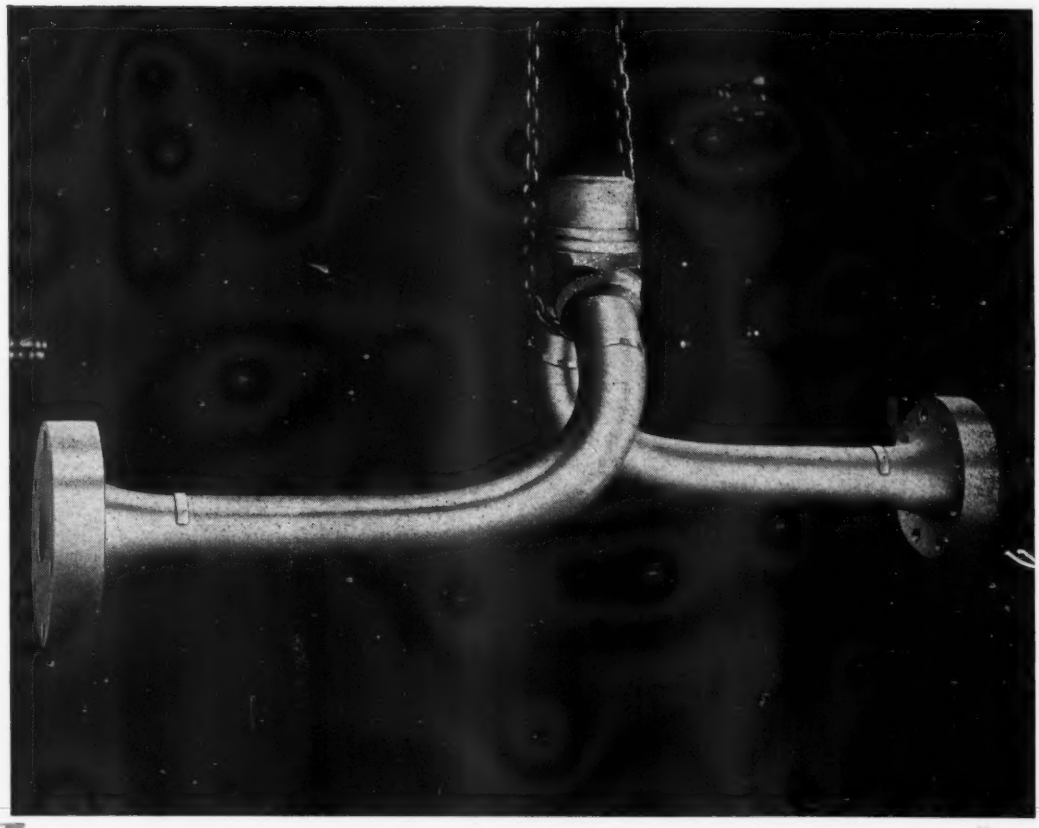
Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.



Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.



Up-to-the-minute . . . because 30 years are behind it

300,000 KW of new electrical power capacity depend on this and companion pieces of piping—destined to connect the throttles and steam chests of three new turbines in a large metropolitan powerhouse. They are made of 18-8 alloy steel—.718" thick, 6⅝" outside diameter, to operate at 1730 psig at 1050°F. There just can't be any defects, any locked-up stresses, any faulty metal formations, or deviations from contour, no matter how minor—not in piping as important as *this*.

Kellogg started preparing for this order more than thirty years ago . . . when a turbine was a textbook subject and 18-8 was just out of the laboratory. It was then that Kellogg started to amass alloy performance data . . . started to investigate methods of welding and heat treatment . . . established the nucleus of the present Kellogg Metallurgical Laboratory and Quality Control System.

The data, the amassed knowledge, the fabricating experience of thirty years are as apparent in the perfection of these vital power connections for industry as they are in the pioneering work which Kellogg metallurgists are now undertaking in the newer and more dramatic fields of gas turbine, rocket and ram jet propulsion devices.

When you place orders today with Kellogg for critical power piping you know that each piece of piping delivered, bearing the Kellogg stamp, will have this same thirty years of preparation behind it.

FABRICATED PRODUCTS DIVISION

THE M. W. KELLOGG COMPANY

A SUBSIDIARY OF PULLMAN INC.

NEW YORK • JERSEY CITY • BUFFALO • LOS ANGELES
TULSA • HOUSTON • TORONTO • LONDON • PARIS

VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING
PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

TORTURED ON THE RACK FOR LONGER SERVICE LIFE

QUAKER PRE-TESTED PRODUCTS FOR POWER FIELD ASSURE LONG TROUBLE-FREE SERVICE

Test the finished products until they break down! That's the aim of the technical men in Quaker's modern laboratories. The results of these torture-tests are the reasons why Quaker Hose, Belting, Packings, moulded goods and other industrial products stand up so much longer in use. They're pre-tested and performance-proved!

The adhesion test shown is just one of the 18 torture-tests. Here weights are attached to the rubber section of the product for the purpose of stripping off the fabric. Tight adhesion of rubber-to-fabric is an important factor in the long-lasting quality of belting, hose and packings. Checking the adhesive qualities of rubber in Quaker products assures strong resistance to ply separation . . . prevention of product breakdown in service.

For higher plant efficiency and lower operating costs specify long-lasting, pre-tested Quaker Products. Call your nearest Quaker distributor. He and the Quaker sales engineer are teamed to provide accurate recommendations on industrial rubber products.

QUAKER RUBBER CORPORATION

PHILADELPHIA 24, PA. • New York 7 • Cleveland 15 • Chicago 16 • Houston 1
Western Territory
QUAKER PACIFIC RUBBER CO. • San Francisco 10 • Los Angeles 21 • Seattle 4

QUAKER RUBBER CORPORATION · PHILADELPHIA, PA. · QUALITY SINCE 1885
REG. U. S. PAT. OFF.

QUAKER *Pre-Testing* OFFERS THE POWER FIELD

BELTING FOR MAXIMUM HORSEPOWER TRANSMISSION

Huge flat belts driving large flywheels or small fractional horsepower drives on small motors . . . Quaker pre-testing develops belts for every need of the Power Industry . . . belts to assure peak efficiency under all operating conditions.

HOSE THAT STANDS WEAR AND ABRASION

Hose for air, steam, water, oil, gas, chemical, fire or paint, Quaker makes it and makes it to fit the needs of the Power Industry . . . each length of Quaker hose is made right . . . pre-testing assures peak-performance.

PACKINGS FOR TIGHTER SEALS . . . LONGER WEAR

Quaker packings are scientifically engineered for every use—for pumps, refrigeration compressors, water lines, valves and the many other places in the Power Industry. Each pre-tested for positive performance.

QUAKER RUBBER PRODUCTS
custom made for every industrial use

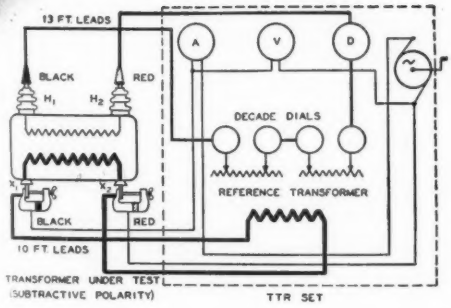
. . . a new instrument for measuring turn and voltage ratio in transformers.

THIS new testing set meets a long-felt need for a portable, simple-to-use and highly accurate device for measuring turn and no-load voltage ratio in power and distribution transformers and auto-transformers. It is operated by one man and is suitable for both shop and field use.

With the "TTR" you can—

- Measure the turn ratio of new, repaired and rewound units.
- Check polarity.
- Quickly identify leads and taps.
- Check tap-changer settings.
- Investigate load division and circulating current between units or banks.
- Detect shorted or missing turns.
- Locate concealed faults.

The "TTR" Set is an invaluable tool in transformer work . . . checking new units . . . at time of trouble . . . during and after repairs. It consists essentially of a reference transformer, adjustable in ratio from zero to 130, in parallel with the transformer under test. The result is read directly from the position of four dial switches adjusted to null balance. It is completely self-contained including an 8-volt hand generator, test leads and clamps. No other equipment is necessary. For more complete, detailed information we invite you to write for *Bulletin 55-P.*



Principle of operation of the "TTR" Set and connections to transformer under test.

JAMES G. BIDDLE CO.

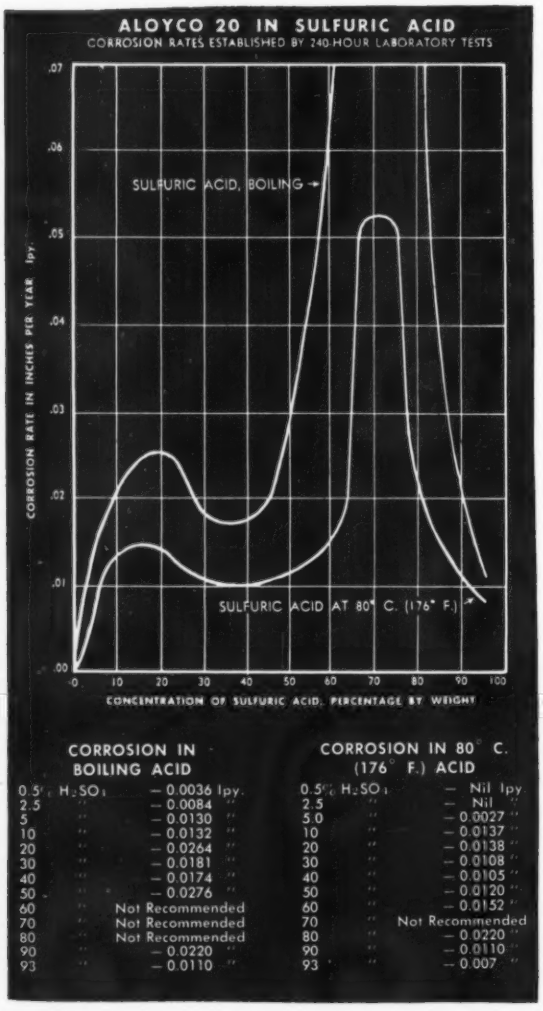
Electrical & Scientific Instruments

1316 ARCH STREET, PHILADELPHIA 7, PA.

ALOYCO 20 VALVES
FOR SULFURIC ACID PIPE LINES

ALOYCO 20 is one corrosion-resistant alloy that really stands up to sulfuric acid under most operating conditions. At room temperatures, Aloyco 20 is practically unaffected in any concentration of H_2SO_4. It is also satisfactorily resistant at the boiling point up to 45% acid strength. In concentrations between 45% and 93%, temperature is an influencing factor. Our metallurgical service is well qualified to recommend regarding proposed applications in this range.

Aloyco 20 also has strong resistance to the effects of high strength sodium hydroxide, hot acetic acid, acetic anhydride vapors and hot nitric-sulfuric solutions. This alloy has wide use among manufacturers of oil refinery products, fertilizers, plastics, rayon, soap, synthetic rubber, coal tar products, explosives and many others. Consult us on your requirements.



CORROSION IN BOILING ACID		CORROSION IN 80° C. (176° F.) ACID	
0.5% H_2SO_4	— 0.0036 ipy.	0.5% H_2SO_4	— Nil ipy.
2.5 "	— 0.0084 "	2.5 "	— Nil "
5 "	— 0.0130 "	5.0 "	— 0.0027 "
10 "	— 0.0132 "	10 "	— 0.0137 "
20 "	— 0.0264 "	20 "	— 0.0138 "
30 "	— 0.0181 "	30 "	— 0.0108 "
40 "	— 0.0174 "	40 "	— 0.0105 "
50 "	— 0.0276 "	50 "	— 0.0120 "
60 "	Not Recommended	60 "	— 0.0152 "
70 "	Not Recommended	70 "	Not Recommended
80 "	Not Recommended	80 "	— 0.0220 "
90 "	— 0.0220 "	90 "	— 0.0110 "
93 "	— 0.0110 "	93 "	— 0.007 "

● Aloyco Gate Valve No. 111. Has double disc wedge that provides drop-tight closure and long life under severe operating conditions. Available in Aloyco 20, 18-8S, 18-8SMo, the higher chrome-nickel series, Worthite, Hastelloy, Monel, and pure nickel.

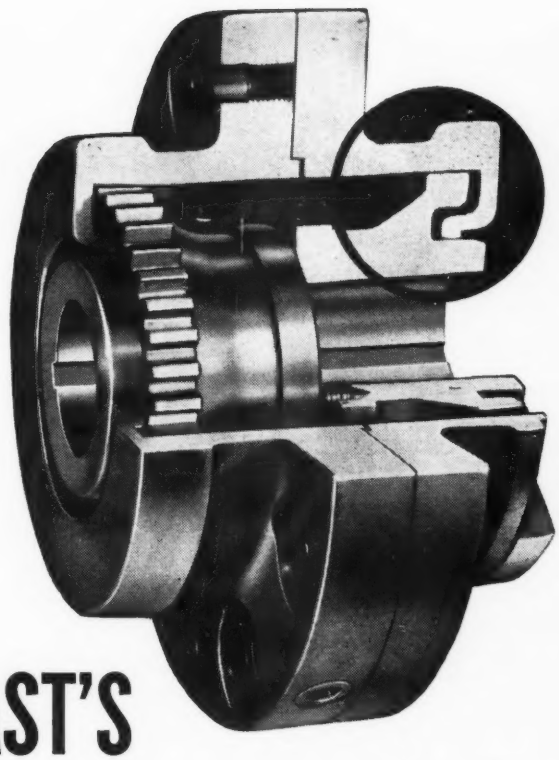
ALOYCO

STAINLESS STEEL VALVES AND FITTINGS

GATE, GLOBE, Y, CHECK, TANK, SAMPLING AND V-PORT VALVES
SCREWED AND FLANGED FITTINGS

ALLOY STEEL PRODUCTS COMPANY, INC.

1403 WEST ELIZABETH AVE. • LINDEN, N. J.



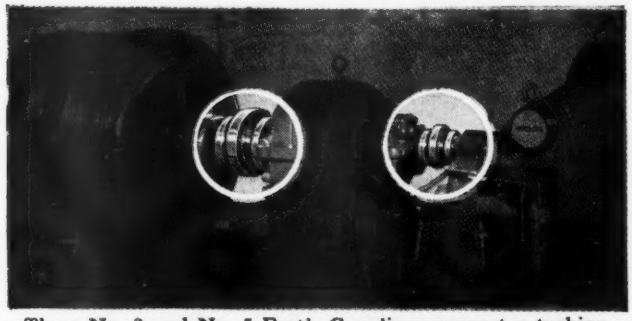
FAST'S

ALL-STEEL Construction Gives NON-STOP Power Transmission!

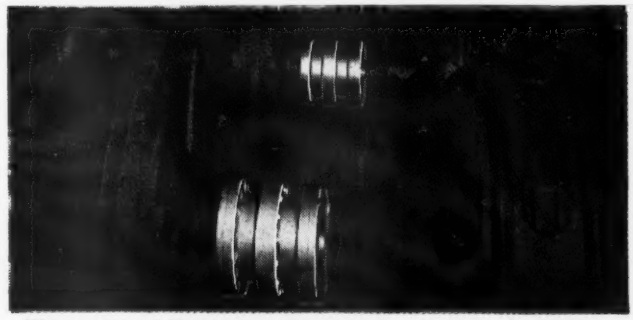
These installations have an important feature in common. They're all protected against coupling shutdowns by Fast's self-aligning Couplings. That's because these original gear-type couplings are all-steel throughout, *without perishable parts!* Even the load-carrying oil is protected by an *exclusive* "rocking bearing." This bearing is *exclusive* in providing a positive metal-to-metal seal which keeps out moisture, dust and grit. The bearing is also *exclusive* in its correctly engineered position which allows *freedom of movement* to compensate for misalignment because its *spherical* base has *the same axis* as the hub spline faces. No perishable packing rings are used in this vital spot.

We have a complete line of couplings for immediate delivery. No matter which type of Fast's Couplings you buy, you get the benefits of years of top engineering experience, Koppers' high standards of workmanship and unexcelled coupling service which assure you of spare parts no matter how old your couplings may be. That means non-stop power transmission, longer machine life, lower costs, minimum shutdown losses! Koppers Co., Inc., Fast's Coupling Dept., 341 Scott St., Baltimore 3, Maryland.

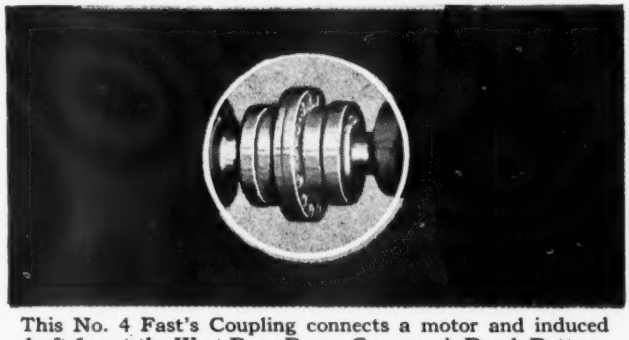
Fast's Coupling connects 1,800 h.p., 600 r.p.m. motor to 30 million-gallon-per-hour pump at City of Montreal pumping station.



These No. 3 and No. 5 Fast's Couplings connect a turbine-reduction gear-generator hookup, 1125 h.p. at 3740/1200 r.p.m., at Firestone Steel Products Co., Akron, Ohio.



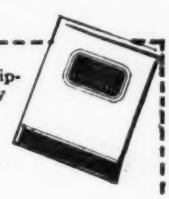
This group of Fast's Couplings has been giving trouble-free service since 1922 at the Western Maryland Dairy Company's Baltimore plant.



This No. 4 Fast's Coupling connects a motor and induced draft fan at the West Penn Power Company's Beach Bottom, W. Va., plant.

K KOPPERS

FAST'S *self-aligning* COUPLINGS



SEND FOR FREE CATALOG giving detailed descriptions, engineering drawings, dimension and capacity tables and typical installation photographs for the many types of Fast's Couplings. Fill out this coupon and mail it to: Koppers Co., Inc., Fast's Coupling Dept., 341 Scott St., Baltimore 3, Md.

NAME.....POSITION.....

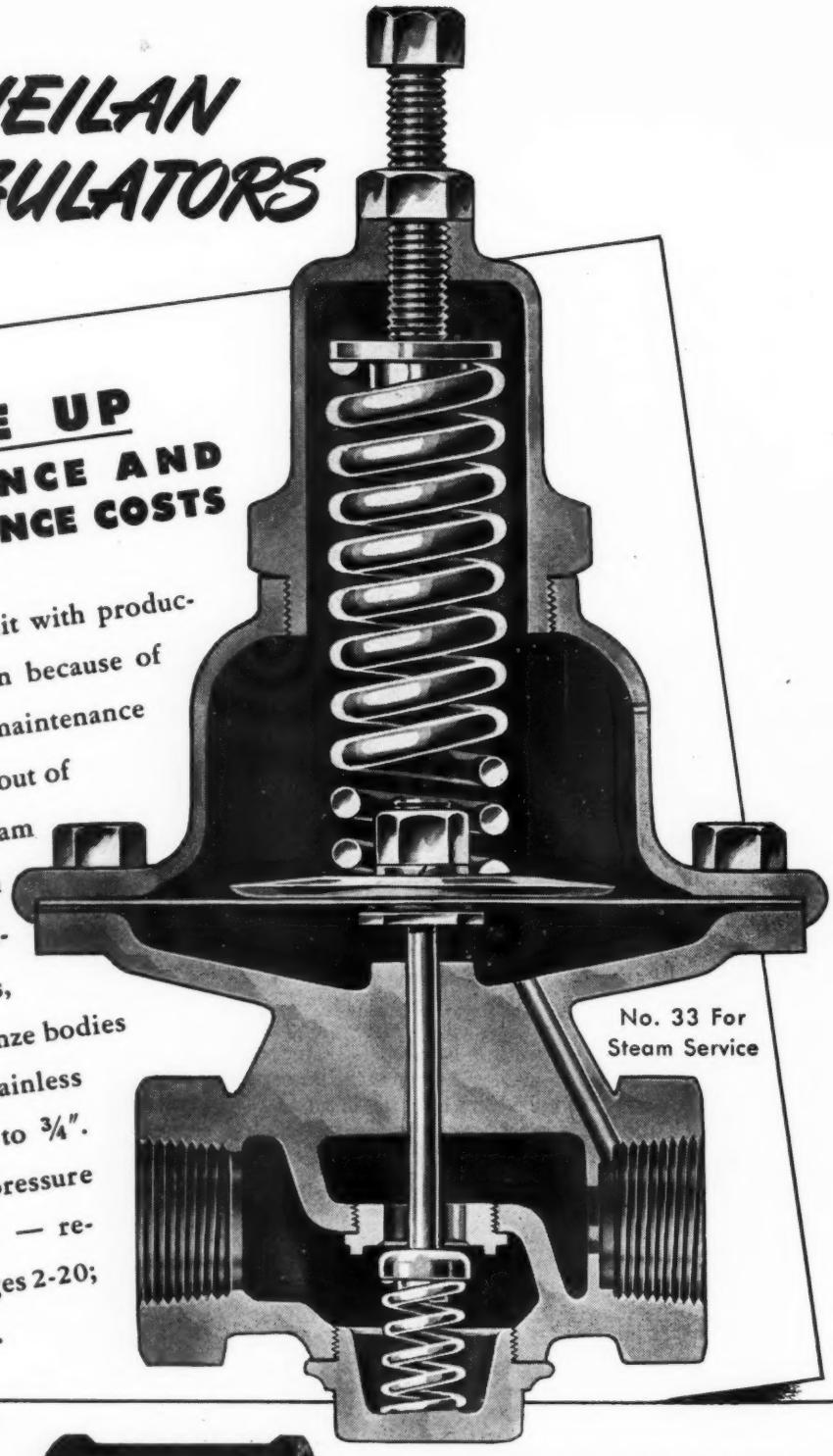
COMPANY.....

STREET.....CITY.....STATE.....

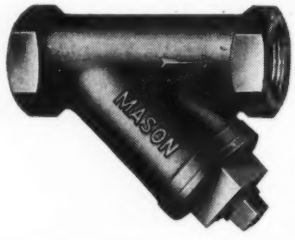
MASONEILAN NO. 33 REGULATORS

MEASURE UP
IN PERFORMANCE AND LOW MAINTENANCE COSTS

These regulators make a hit with production and maintenance men because of their dependability, low maintenance cost and minimum time out of service. Use them for steam pressure reducing on small stills, kettles, sterilizers, presses, washers, vulcanizers, etc. ... Bronze bodies with screwed ends, stainless steel trim, sizes 1/8" to 3/4". Maximum working pressure 200 psi @ 400°F. — reduced pressure ranges 2-20; 20-60; 60-100 psi.



No. 33 For Steam Service



MASONEILAN STRAINERS

Use these strainers to prevent scale, dirt, chips, etc., from damaging regulators, traps, valves and pumps. These strainers keep out foreign matter. They eliminate maintenance delays and thus save money.

MASONEILAN

MASON-NEILAN REGULATOR COMPANY

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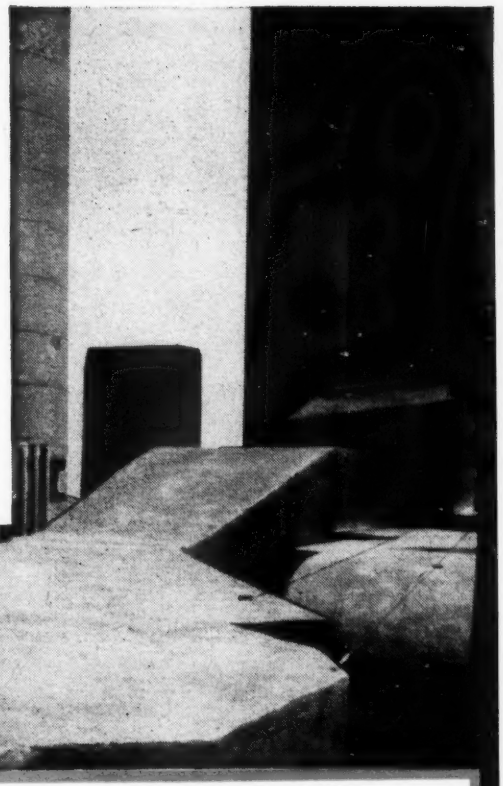
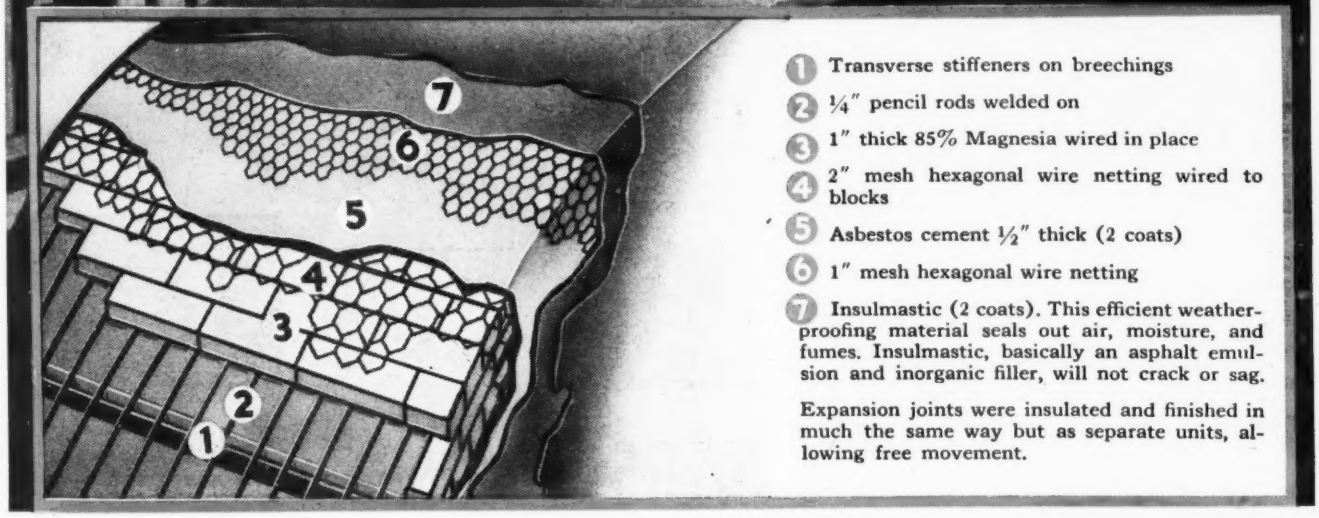
Sales Offices or Distributors in the Following Cities: New York • Buffalo • Chicago • St. Louis • Philadelphia Houston • Pittsburgh • Cleveland • Tulsa • Atlanta • Denver • Cincinnati • Los Angeles • San Francisco

Mason Regulator Co. of Canada, Ltd., Montreal and Toronto

How would YOU protect this breaching?

HERE'S THE PROBLEM: If left open to the weather, this outdoor metal breeching will chill the 350° to 400° F. gases passing through it, causing condensation and corrosion inside the breeching. What's the best way to insulate it to prevent this condensation and prolong the life of the breeching?





1. Transverse stiffeners on breechings
2. ¼" pencil rods welded on
3. 1" thick 85% Magnesia wired in place
4. 2" mesh hexagonal wire netting wired to blocks
5. Asbestos cement ½" thick (2 coats)
6. 1" mesh hexagonal wire netting
7. Insulmastic (2 coats). This efficient weatherproofing material seals out air, moisture, and fumes. Insulmastic, basically an asphalt emulsion and inorganic filler, will not crack or sag.

Expansion joints were insulated and finished in much the same way but as separate units, allowing free movement.

HERE'S WHAT THE ARMSTRONG ENGINEER ADVISED:

Although insulation is generally used to conserve heat or refrigeration, sometimes it is applied mainly for the protection of equipment.

In the case outlined here, insulation was necessary to protect the metal from damage caused by condensation. Complete protection was assured with the specification detailed in the cutaway view above.

Whatever your heat insulation problem, there's a trained engineer in a near-by Armstrong office who can help you. And Armstrong's Contract Service will back him up with correct materials and sound workmanship for the job.

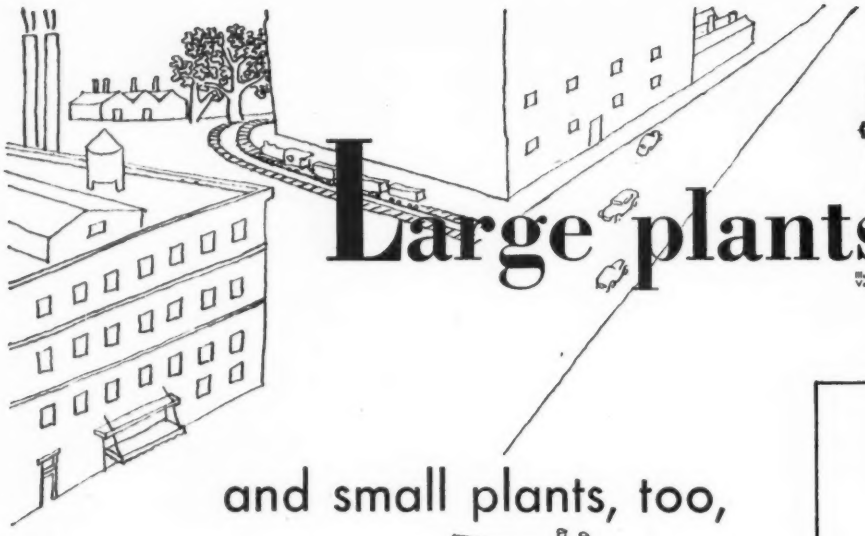
FREE INSULATION CHART
This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write today to Armstrong Cork Co., Industrial Insulation Department, 7011 Maple Avenue, Lancaster, Pa.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service
For All Temperatures

From 300° Below Zero

To 2800° Fahrenheit



Large plants

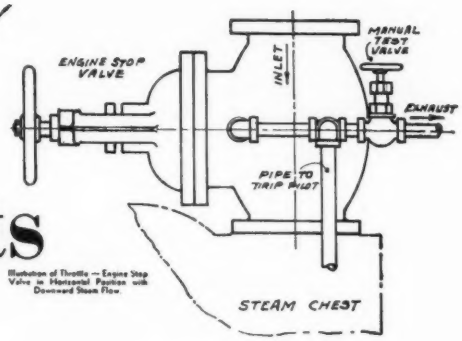
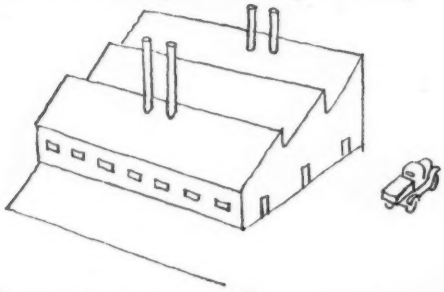
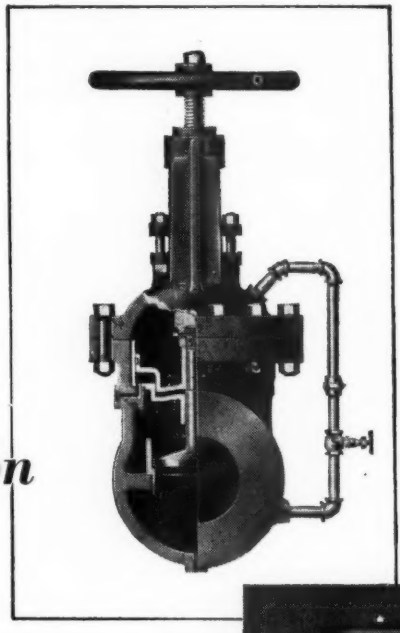


Illustration of Throttle — Engine Stop Valve in Horizontal Position with Downward Steam Flow

and small plants, too,





need this Engineered protection

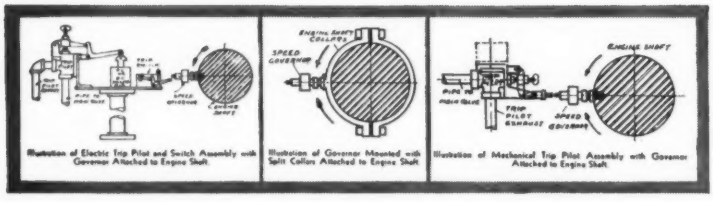
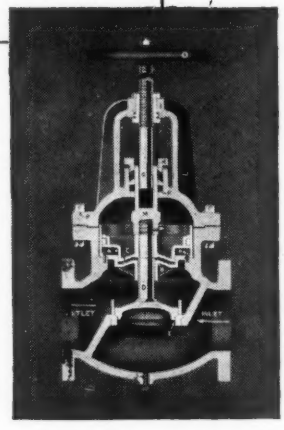


Illustration of Electric Trip Pilot and Switch Assembly with Governor Attached to Engine Shaft

Illustration of Governor Mounted with Split Collars Attached to Engine Shaft

Illustration of Mechanical Trip Pilot Assembly with Governor Attached to Engine Shaft



GOLDEN-ANDERSON

Throttle

and

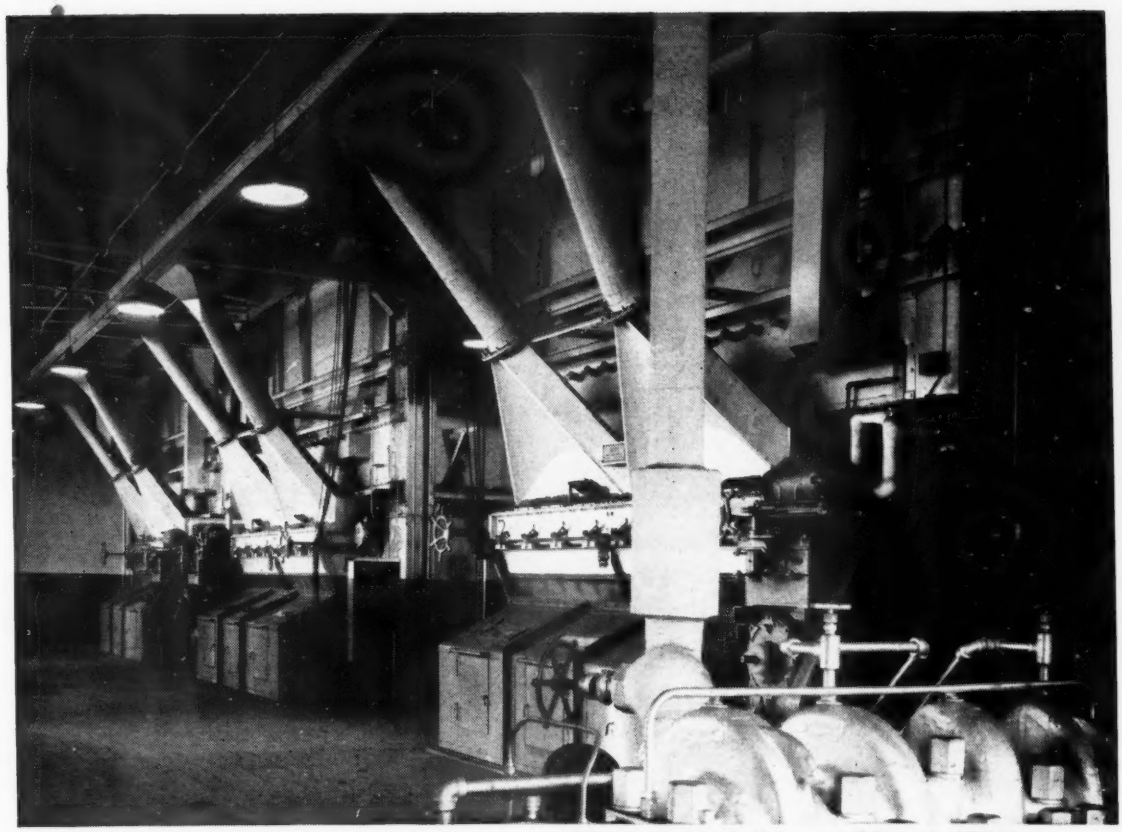
Automatic

engine stop

Valves

Throttle and Automatic Engine Stop Valves by Golden-Anderson have saved manufacturers many thousands of dollars in property and personnel damage from run-away engines and turbines. These valves are completely automatic, but a remote control attachment is included to permit manual operation for tests and other purposes. When handwheel stem is run up, the valve will automatically open to admit pressure into engine or turbine, thus permitting easy return to engine operation. For complete information on the more than 1500 types and sizes designed and built by Golden-Anderson, write for new catalog today.

GOLDEN-ANDERSON *Valve* **Specialty Co.,** KEENAN BUILDING, Pittsburgh 22, Pa.



View in modern boiler room of Sherwin-Williams plant, Chicago.

75% Make-Up Water Conditioned for Maximum Efficiency with *Dearborn* Treatment and Test Control

As a sound protective measure, new boilers in a modern plant should rely on advanced water conditioning techniques for steaming efficiency. Dearborn's contribution to top performance in this plant is the installation of a program of scientific external and internal water treatment and test control designed to meet operating conditions.

The three boilers at Sherwin-Williams plant, which use approximately 75% make-up water, are operating continuously on a scale- and corrosion-free basis under an individualized Dearborn treatment program. After systematic tests carried on by the Dearborn Engineer in the boiler room, recommended treatment formulations are introduced automatically in proportion to water requirements. Systematic water test routine has been established to maintain treatment balance. This program is producing highly satisfactory results. Similar programs are producing excellent results in numerous power plants.

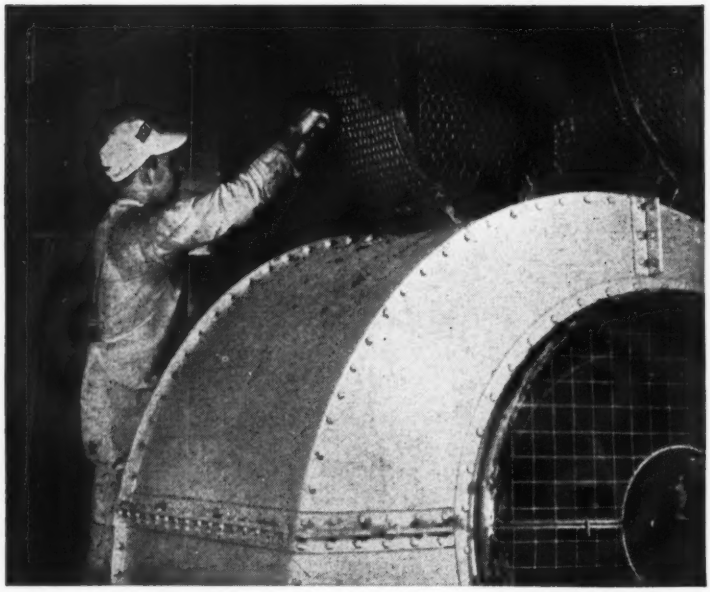
You are invited to investigate what Dearborn service can do for you. Call your near-by Dearborn Engineer or write direct to us.

DEARBORN CHEMICAL COMPANY
310 S. Michigan Ave., Chicago 4 — 807-15 Mateo St., Los Angeles
205 E. 42nd St., New York — 2454 Dundas St., West, Toronto

THE LEADER IN

Dearborn
TRADE MARK REGISTERED

BOILER WATER TREATMENT



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Insulations

Eagle-Picher Super "66" Insulating Cement

All-purpose . . . for permanent efficiency

"Springy Ball" pellets of Eagle-Picher Mineral Wool contain thousands of minute dead air cells that give Super "66" tremendous insulating efficiency. These pellets retain their form even after the insulation dries, to preserve permanently extremely low thermal conductivity. In addition, Super "66" actively inhibits rust on metal equipment. It's all-purpose, sticks to any shape surface, and withstands temperatures up to 1800 F. Complete technical and application data on request.

Let these Eagle-Picher products also save you money . . . power . . . time

Insulating Felts
Supertemp Block • Blankets
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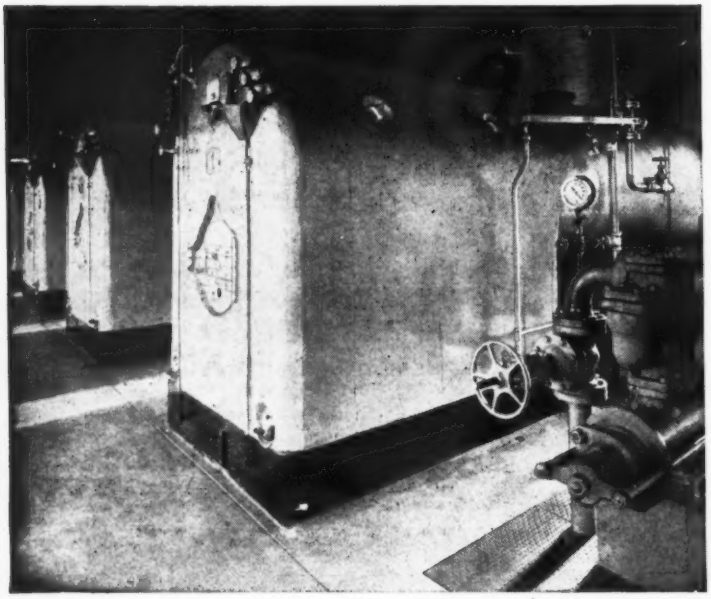
Insulating Cements



EAGLE-PICHER INSULATIONS for

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High and low temperature

Since 1843
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Are Power Plant Coal Bills Too High?

In many cases, steam generating costs are too high because coal purchases are limited to a narrow range of costly premium coals—with little or no possibility of purchasing the best coal value available in a changing or competitive market.

Modern power plant design has advanced to the point where complete fuel flexibility is entirely possible. The cost to provide fuel flexibility in new plants, or when modernizing existing plants, is but a small part of the capital investment. Yet this small additional investment pays dividends throughout the life of the plant by providing *reliable utilization* of various coals—enabling the operator to purchase the best fuel value under all market conditions.

The Engineering Research Department of the Ohio Coal Association welcomes the opportunity to supply helpful information to power plant designers, owners, and operators on how power plants, large and small, can widen coal selection and reduce coal bills. Inquiries are invited.

THIS BOOKLET contains charts, illustrations, diagrams, and technical data on • fuel flexibility and power costs • how to conduct a fuel investigation for lower power costs • how burning equipment affects fuel performance—and other helpful information of interest to power plant designers, owners and operators. Free on request—write today.

OHIO COAL ASSOCIATION
Engineering Research

OHIO COAL ASSOCIATION

ROCKEFELLER BUILDING • CLEVELAND 13, OHIO

Take a WALWORTH No. 225P Bronze Valve Apart...

COMPARE IT PIECE BY PIECE

It will pay you to look inside the Walworth No. 225P. Compare the improved design, construction and convenience features shown in the "exploded" view. Notice the husky bronze body, the removable seat and disc, the oversize stem, all assuring maximum protection against wear and leakage.

Further, No. 225P is the TOUGHEST bronze valve your money can buy. The stainless steel, noncorrosive seats and discs are heat treated to a hardness of 500 Brinell — hard enough to scratch glass and crush nails. For this reason, the valve can be closed on sand, slag, scale and similar flotage without injury to the seating surfaces, and "wire drawing" is practically eliminated. Thus years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 227P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas or air.

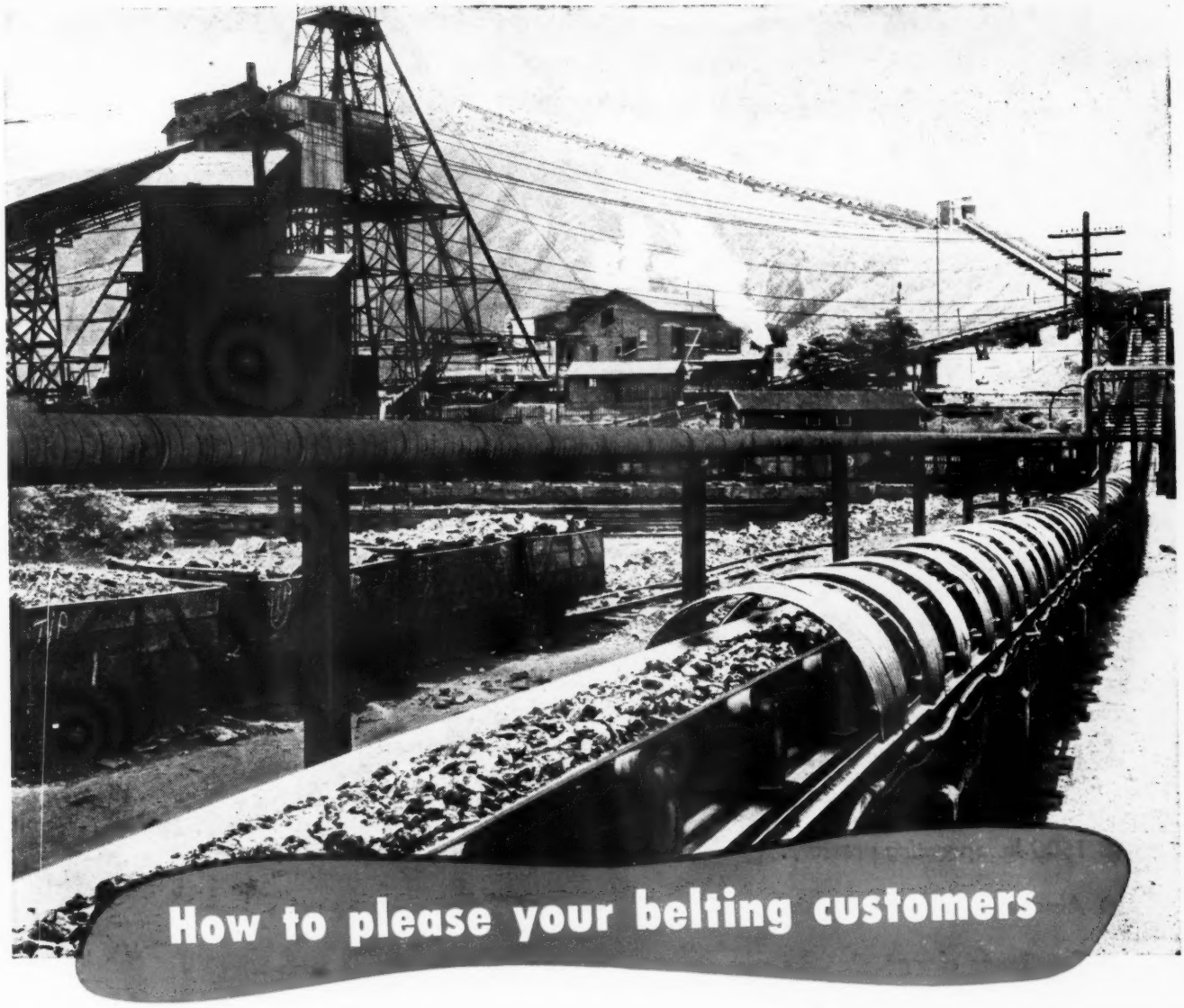
For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular 82.

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



How to please your belting customers

Hewitt Conveyor Belting gives you longer, more dependable service at less cost

Once you see this belting in action, you'll understand why thousands of other wide-awake engineers specify Hewitt for all their belting needs.

You will find, as they have, that you can depend on Hewitt Conveyor Belting for your unusually severe operations. That's because it handles heavy abrasives, like ore and rock—or wet, gritty materials, such as fines and slag, with ease. In short, it is extremely strong belting—built to take tons of trouble off your hands.

You can get Hewitt Belting for all of your needs: Maltese Cross for the really tough jobs, Ajax for general service, and Conservo for lighter applications and portable conveyors. Remember, too, that Hewitt-Robins is the only firm that offers you single responsibility for your entire belt conveyor system.

For engineering services consult Robins Engineers Division, 157 Chambers St., N. Y. For machinery, write to Robins Conveyors Division, Passaic, N. J. For belting, Hewitt Rubber Division, Buffalo 5, N. Y.

HEWITT
CONVEYOR BELTING

HEWITT RUBBER DIVISION
INDUSTRIAL HOSE • BELTING • PACKING

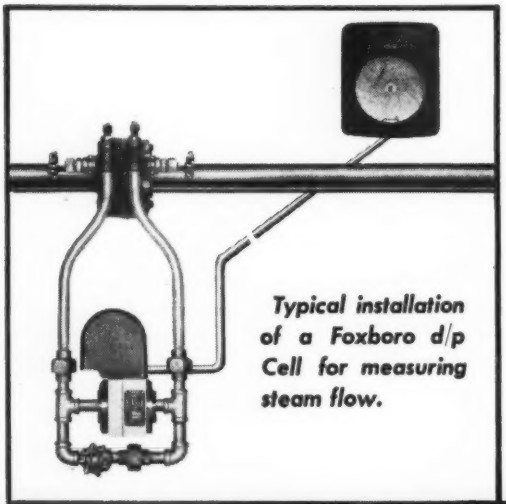
MORE REASONS WHY HEWITT BELTING PROVIDES LONGER SERVICE AT LESS COST

- Hewitt Belting is fully protected to resist moisture, oils, flexing, and ply-separation. It is also treated against mildew.
- Abrasion-resistant covers are made of extra-tough rubber. Rigid-edge construction prevents edges from curling if the belt becomes misaligned during conveying operations.
- Heavy textile reinforcement gives Hewitt Conveyor Belting unusual strength combined with high flexibility.
- You can get these leading types of belting to handle every kind of conveyor service: Maltese Cross for severe jobs, Ajax for general service, and Conservo for lighter applications and portable conveyors.

HEWITT-ROBINS HR **INCORPORATED**

NEW! Revolutionary DIFFERENTIAL PRESSURE CELL SIMPLIFIES MEASUREMENT OF STEAM FLOW

- *Positive, direct, force-balance operation.*
- *Zero displacement.*
- *No mercury used.*
- *All parts exposed to measured fluid are of Type 316 Stainless construction.*
- *1500 lb. operating pressure.*
- *Absolute overrange protection.*
- *Easy range change.*
- *Weatherproof.*



Typical installation of a Foxboro d/p Cell for measuring steam flow.

The new Foxboro d/p Cell is a flexible, easily-calibrated device operating on the highly accurate force-balance principle. *No mercury is used.* It transmits flow measurement to remote, conveniently-located pneumatic receiving instruments (indicating, recording, or controlling). It is small, weighs less than 20 lbs. . . .simple in construction. Absolute built-in overrange protection on both sides.

NO CONDENSING CHAMBERS NEEDED

Essentially zero displacement of the measuring element eliminates the need for condensing chambers. Because of its compact size, the d/p Cell can be installed close to the steam line . . . and the entire installation insulated where there is danger of lead line condensate freezing.

Learn all about this new, unique development. It may be the ideal solution to your measurement problem. Write for Bulletin 420. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.**

FOXBORO
REG. U. S. PAT. OFF.

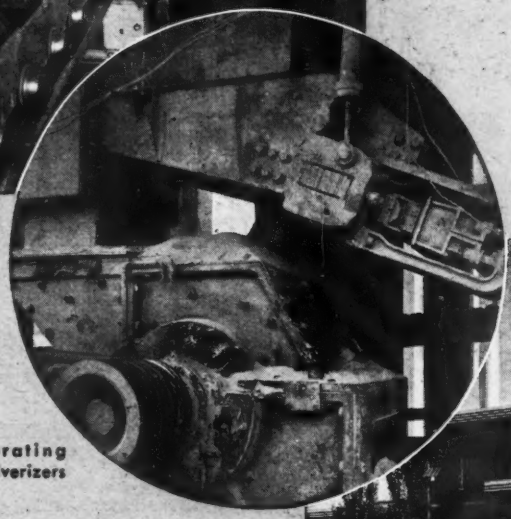
RECORDING · CONTROLLING · INDICATING INSTRUMENTS

FOR SERVICE THROUGH THE YEARS

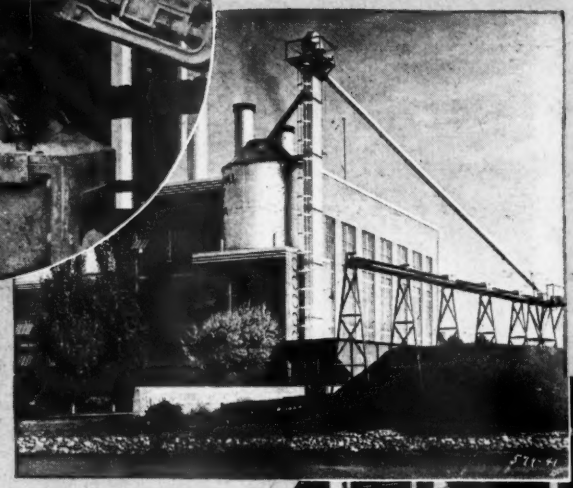
Jeffrey
MATERIAL HANDLING EQUIPMENT

Handling costs are to be found in most unexpected places. The task of detecting all of these, applying remedies and co-ordinating them with the manufacturing scheme, requires specialized skill and experience. Jeffrey has been building material handling equipment for seventy years . . designs almost every type . . some that cannot be obtained elsewhere. Our engineers have built up in these years the experience and skill . . have the resources of devices and material . . to throw wide open a vast source of potential cost reduction. Give us the opportunity to show you.

Steel apron conveyor. (Also wood apron conveyors)

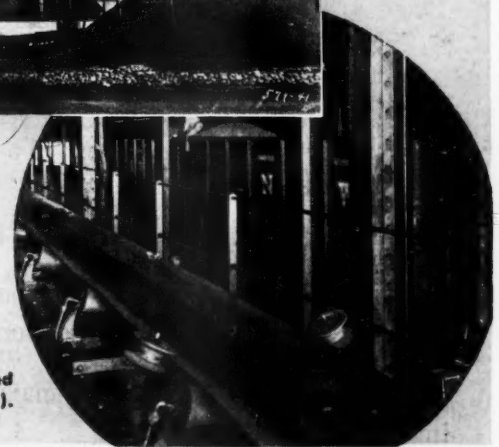


Electric vibrating feeders and pulverizers



Coal and ashes handling — bucket elevators, conveyors, weigh larries, skip hoists, crushers, car pullers, etc.

FOR HANDLING LARGE QUANTITIES OF BULK MATERIAL. A CONSTANT, UNINTERRUPTED FLOW



Belt conveyors (troughed or flat belt types).

THE JEFFREY MANUFACTURING COMPANY

ESTABLISHED 1877

912-99 NORTH FOURTH ST., COLUMBUS 16, OHIO

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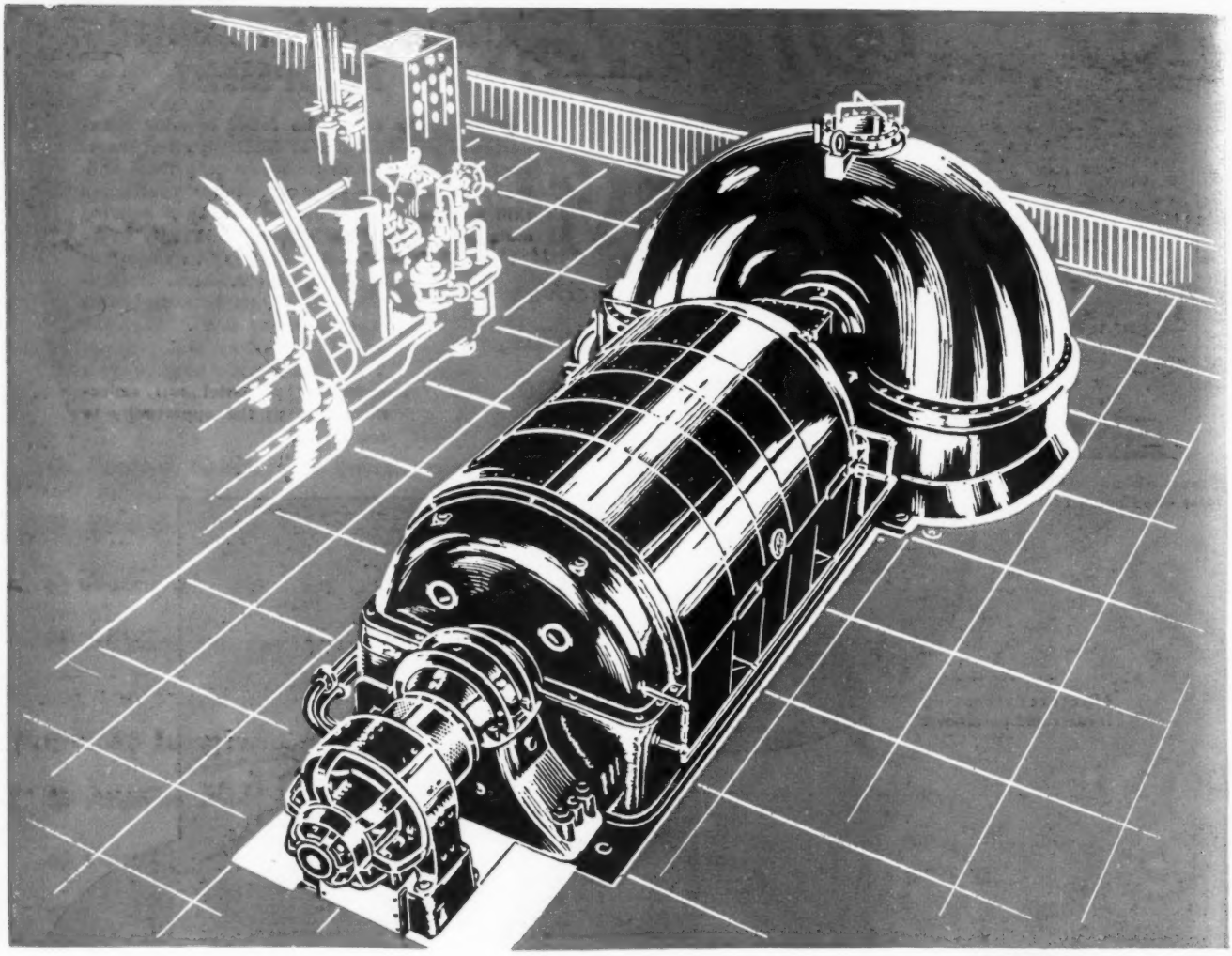
Complete Line of Material Handling, Processing and Mining Equipment

JM

YES! Tycol Aturbrio Turbine Oils perform better . . . BETTER . . . BETTER



Tycol Aturbrio Turbine Oils perform better because:

. . . *Tycol Aturbrio Oils* provide positive protection against oxidation with maximum lubrication efficiency.

. . . *Tycol Aturbrio Oils* provide maximum resistance to sludging and emulsification.

. . . *Tycol Aturbrio Oils* have a purity of refinement . . . service endurance . . . high rust and oxidation inhibiting qualities that combine to make an ideal turbine lubricant.

Complete information on Tycol Aturbrio Turbine Oils is available from your nearest Tide Water Associated Office. Write, wire, or phone, today.

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C.
Pittsburgh • Philadelphia
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Cleveland • San Francisco

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE - NEW YORK 4, N.Y.

LUBRICATION—"ENGINEERED TO FIT THE JOB"

It's Easy TO CHANGE TO DARCOVA

THE ORIGINAL COMPOSITION CUP

MOST engineers and operators in charge of reciprocating pumps are aware that Darcova Pumcups offer distinct advantages over piston packing of other types—that Pumcups last 5, 10, or even 100 times as long, that fluid slippage is all but eliminated, that efficiency doesn't decrease with Pumcup wear, that pump speed can be reduced and volume increased, that power is saved, and that downtime and maintenance expense are cut to a fraction.

But what many of these men are not aware of is the downright simplicity of changing over to Darcova Pumcups. It's easier than replacing with the old type packing.

To simplify the change-over, to prolong liner and pump life, Darling Pistons are recommended. They are carried in stock at all times, can be supplied in various metals and alloys for every industrial need.

For a free bulletin containing complete information, write, or use the coupon below.

Darling Valve & Mfg. Co., Williamsport 8, Pa.
Please send me the free bulletin checked below:
☐ No. 4401 Darcova Pumcups for reciprocating pumps.
☐ No. 4502 Darcova Pumcups for air or hydraulic mechanisms.

Name_____
Company_____
Address_____
City_____ State_____

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & Manufacturing Co.
WILLIAMSPORT, PA.

LESS PARTS TO WEAR —

LESS WEAR ON PARTS

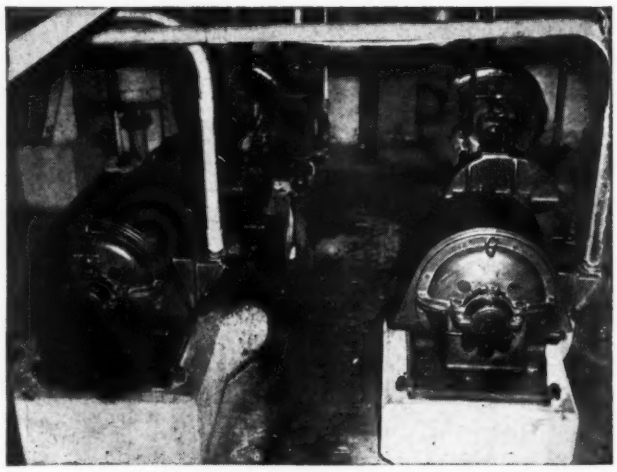
AMSCO-NAGLE PUMPS

CUT ASH HANDLING COST

Only three Amsco-Nagle Pump parts are subjected to the brutal punishing of furnace ash and slag as it is drawn from the power plant sump and delivered to the disposal area. *That's less parts to wear!* The anti-friction bearings are completely sealed off from the water end.

The three parts—end plate, impeller, and casing—are made of Amsco Manganese Steel. *That's less wear on parts!* "The toughest steel known" takes the roughest battering without fracturing . . . polishes and work hardens to as high as 550 Brinell to fight abrasion. (For scouring abrasion without shock stress, Brake Shoe's ABK Metal has proved highly economical.)

There are other reasons why this North Carolina power plant installed two Amsco-Nagle pumps. When repairs are eventually necessary, they're easier, less costly, less time-consuming. Parts are simplified and accessible for easy maintenance. End plate attaches with clamping ring or dogs. Impeller screws on. Supporting tubes on water end slip into sleeves on bearing housing for positive alignment. Stuffing box quickly reached, from above or below, between supporting tubes. Send for Bulletin 547-IP.



AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS, ILL.

Foundries at Chicago Heights, Ill., New Castle, Del., Denver, Colo., Oakland, Calif., Los Angeles, Calif., St. Louis, Mo.
Offices in principal cities. In Canada: Joliette Steel Limited, Joliette, Que.

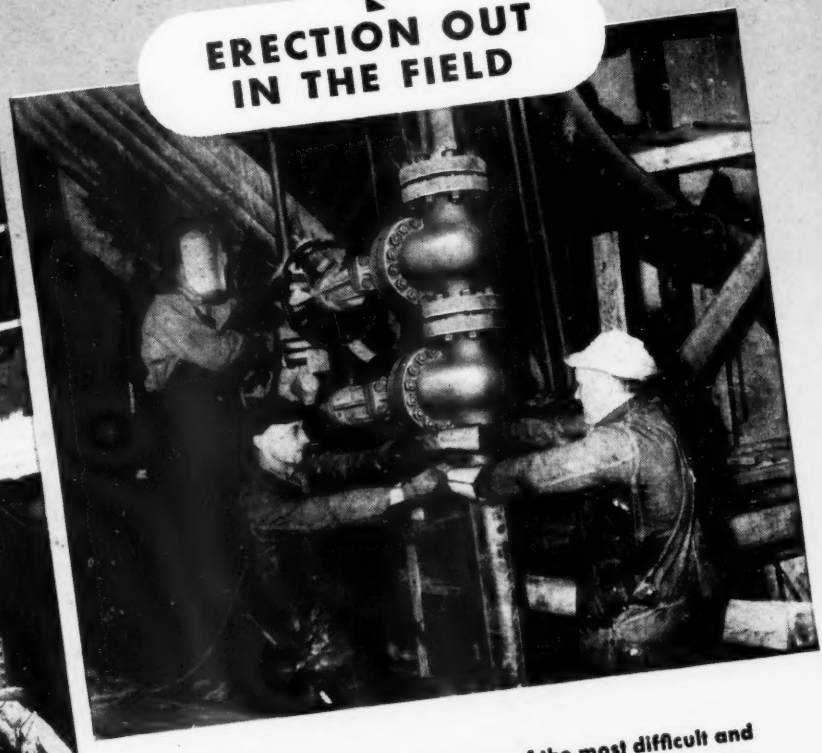
YOU GET BETTER PIPING

because MIDWEST knows piping problems

INSIDE and OUT

PREFABRICATION IN THE SHOP

ERECTION OUT IN THE FIELD



Because Midwest has erected some of the most difficult and exacting piping jobs out in the field, in addition to having prefabricated them in the shops, we have a clear, competent view of piping problems from every angle.

Our Fabricating Department works closely with the Contracting Department . . . continually seeking ways of making their job easier, less costly, and higher in quality. The Contracting Department is always ready to make practical suggestions for improving prefabricated piping subassemblies. It is in constant and intimate touch with piping users in all types of industry. Changes in needs—changes in thinking are quickly relayed to the whole Midwest organization.

The net result to you is better piping whether you want a simple pipe bend . . . a series of complex prefabricated subassemblies . . . or a difficult piping job completely erected.

MIDWEST PIPING SERVICE IS NATION-WIDE

4 PLANTS ARE BETTER THAN 1

PIPING FABRICATORS AND CONTRACTORS

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Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and South Boston

Sales Offices: New York 7—30 Church St. • Chicago 3—79 West Monroe St.
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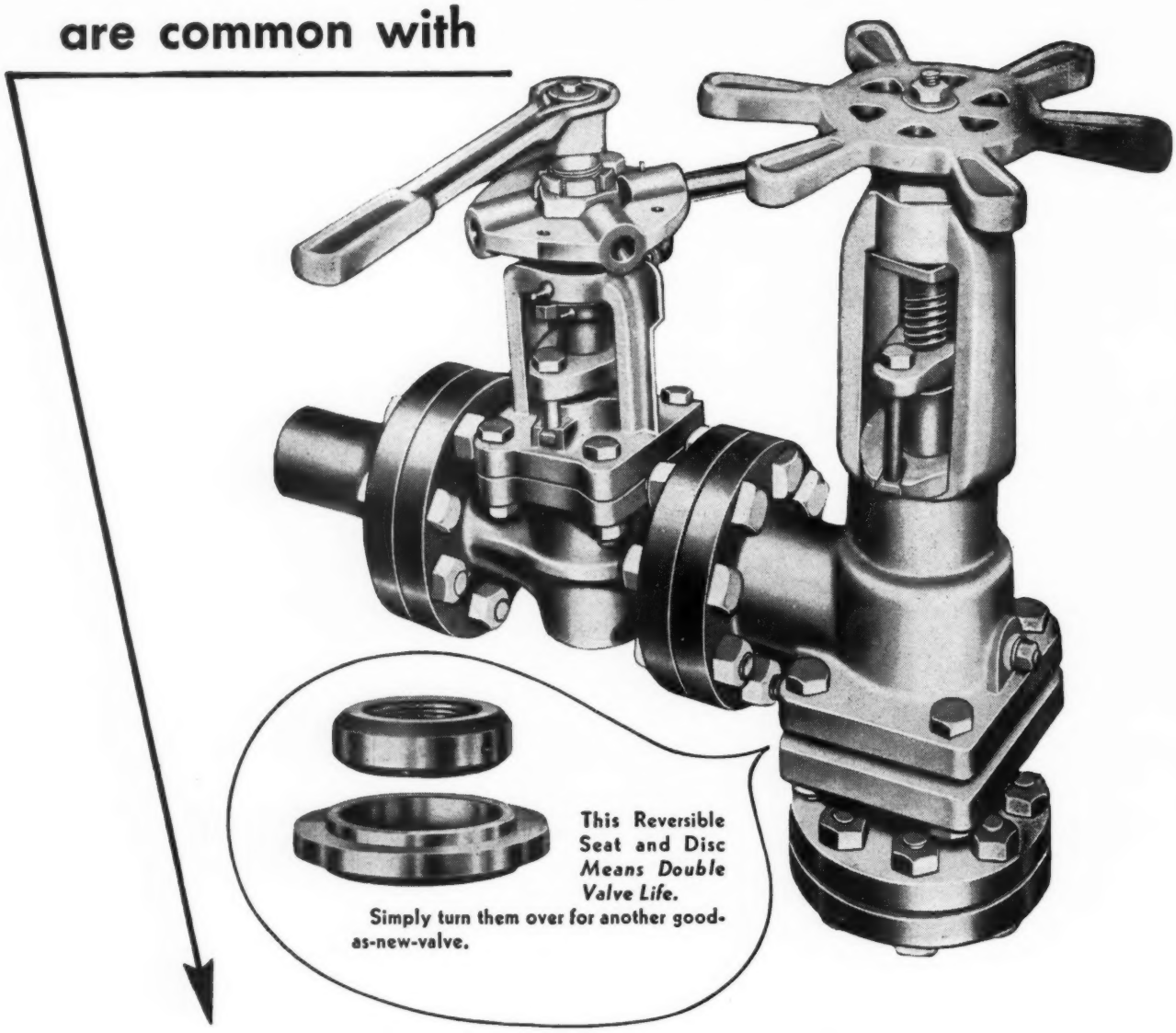
Tulsa 3—533 Mayo Bldg. • South Boston 27—426 First St.

. . . records of 30 years continuous service

are common with



HOVALCO-HOMESTEAD
BOILER BLOW-OFF VALVES

- THEY'RE *BUILT TO OUTLAST THE BOILER*
- AND THEY COST *30% TO 60% LESS TO MAINTAIN.*

Double the life span of ordinary valves is assured when you use Hovalco-Homestead Boiler Blow-Off Valves because built into each valve is a special, *reversible,* long-wearing, S Monel seat and disc which is actually an "extra" set of accurately ground, perfectly matched seating surfaces ready to be put into service whenever the need arises. By simply unbolting the lower valve body and turning over the seat and disc, you have a good-as-new valve ready for another long lifetime of service.

In combination with Homestead Lever-Seald or Cam-Seald Quarter-Turn Valves, they meet A.S.M.E. requirements and all state laws for boiler blow-off service.

We can furnish them in sizes 1½", 2" and 2½" for pressures to 600 pounds. Detailed information and a copy of Valve Reference Book No. 38 are yours for the asking. Write us.

HOMESTEAD VALVE MFG. CO.

P. O. BOX 210 CORAOPOLIS, PA.

A Distributor serves you Best

Republic Cotton Reinforced Steam Hose, designed for industrial applications, operates under pressure up to 150 pounds for innumerable uses. The body is constructed with multiple plies of strong, hard woven, pressure resisting duck. Tube, friction, and cover provide maximum heat resistance.

Distributors of Industrial Supplies Reduce *4 Inventory Hazards for You*

Line

POINT NUMBER ONE IN REPUBLIC'S FIVE POINT POLICY

A line of rubber items sufficiently complete to permit effectively supplying the requirements of the trade solicited.

For cautious inventory control, use the distributors of industrial supplies because:

1. **They protect you from inventory cost fluctuation.**
2. **Their inventory protects you from deterioration.**
3. **They eliminate the tendency of overstocking.**
4. **Fewer items are exposed to "borrowers."**

Records show that distributors of industrial supplies are willing to carry sufficient stock to service territories properly and completely . . . and, 91% are increasing their inventories as fast as materials become available.

Call in your distributor of industrial supplies to make sure his inventory dovetails with your requirements.

A QUARTER CENTURY OF PROGRESS

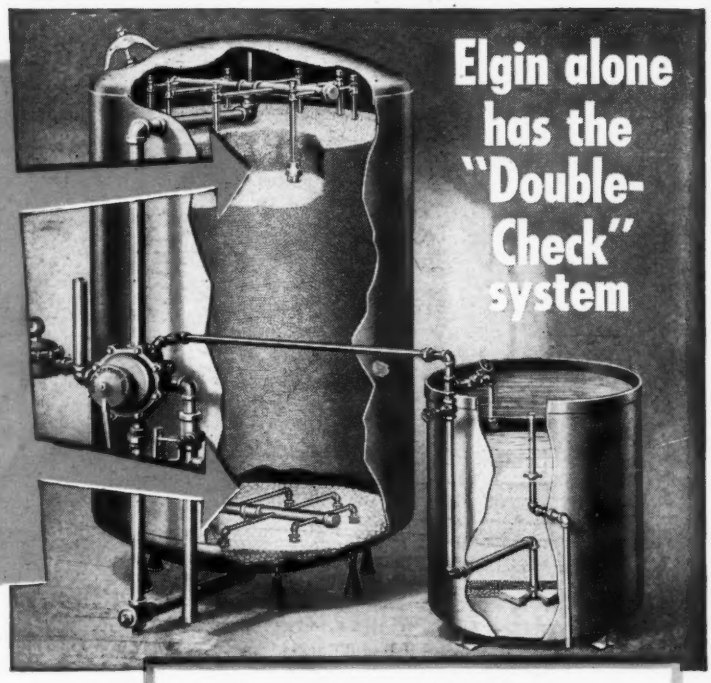
MECHANICAL RUBBER GOODS BY

REPUBLIC RUBBER DIVISION

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION . . . YOUNGSTOWN, OHIO
Lee DeLuxe Tires & Tubes, Conshohocken, Pa.

Yes, ELGIN GIVES YOU

A 44% SOFT WATER BONUS



AN operating man said to one of our engineers: "44% more soft water is a lot of water to swallow. On what basis and by what magic do you accomplish this?"

It is not surprising that a claim as strong as ours should be challenged. But we assure you there is no "catch." When we say Elgin gives up to 44% more soft water we mean specifically that the Elgin "Double-Check" Zeolite Softener *gives up to 44% more soft water per regeneration than any other softener of equal size.*

As to how we do this, there is no mystery. We simply use more zeolite in a softener of given size and get more work out of the zeolite we use. The two accompanying diagrams tell the story. They show two zeolite softeners of equal size. One is the Elgin "Double-Check" design; the other is a softener of ordinary design. Notice that the softener of conventional design contains far less zeolite than the Elgin of the same size. This far shallower bed is necessary in the ordinary softener to prevent loss of zeolite during the regeneration process. In the Elgin Softener the "Double-Check" manifold arrangement prevents the escape of zeolite during regeneration, even when backwashed at a faster and more effective rate. That's why an Elgin Softener of given size can contain so much more zeolite.

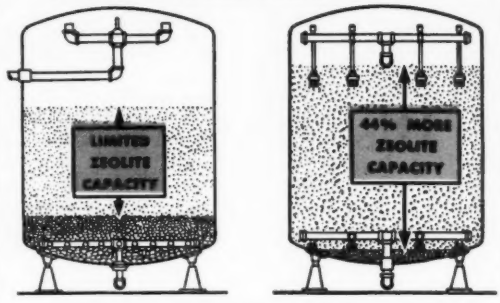
Of course more zeolite means more water softening capacity. But note, also, that by preventing escape of zeolite with the "Double-Check" manifold we also can use a higher backwash rate which means better opening up and re-grading of the zeolite bed, more thorough regeneration by the brine, maximum use of the zeolite throughout the service period. The Elgin output stays zero soft all the way!

Yes, the Elgin "Double-Check" does pay you a bonus—in soft water delivered. It costs less to buy in terms of gallons delivered, occupies less space, costs less to operate and less to maintain. Eloquent proof of the advantages of the Elgin "Double-Check" design is found in the fact that hundreds of engineers have had the Elgin "Double-Check" manifolds installed in their present softeners of other makes to obtain extra gallons of soft water the Elgin "Double-Check" Way.

Give your present softener greater capacity

You can get as much as 3 to 10 times more soft water from your present softener, regardless of make, by installing Elgin "Double-Check" manifolds and Elgin Super-Capacity Zeolite. Cost is low.

These diagrams tell the story—



ORDINARY DESIGN ELGIN DESIGN
SAME SIZE UNIT—SAME TYPE ZEOLITE

Ask for information on these other Elgin Water Conditioning Products

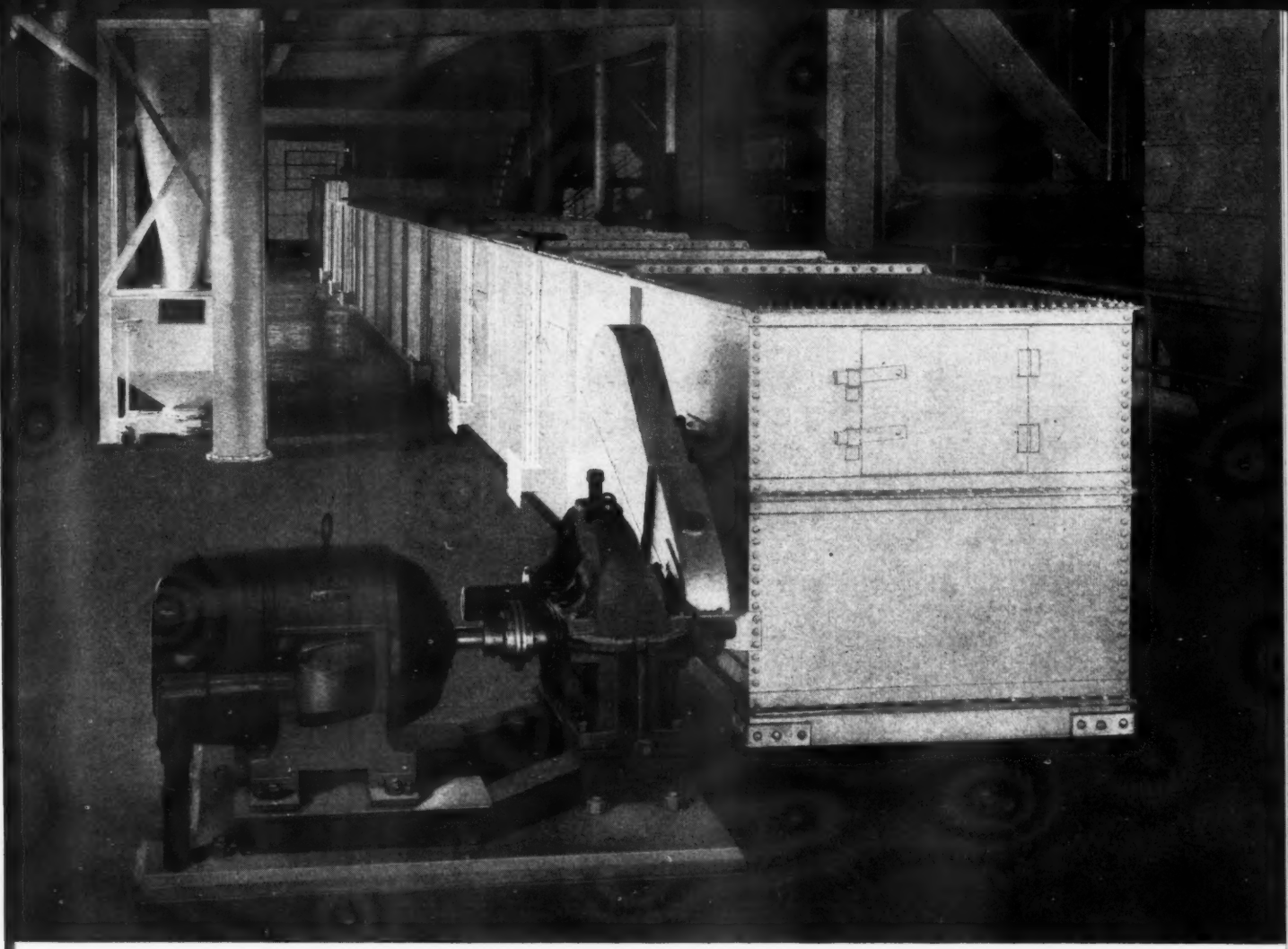
- Boiler feed water treatments
- Post treatments for softened water
- Corrosion prevention treatments for steam systems
- Corrosion prevention for hot and cold water lines
- Deconcentrator systems
- Filters and purifiers
- Iron removal equipment
- Aerators
- Chemical feeders
- Water testing equipment
- Elgin Quality Zeolites—all types

Let an Elgin Engineer Help You Plan . . .

ELGIN SOFTENER CORPORATION

30 NORTH GROVE AVENUE, ELGIN, ILLINOIS • REPRESENTATIVES IN PRINCIPAL CITIES

SOFTENERS ★ FILTERS ★ WATER TREATMENT ★ BOILER WATER CONDITIONING



Dust-tight coal distribution to bunkers

THE picture above, taken in the Bryce E. Morrow Station of the Consumers Power Company near Comstock, Mich., shows the equipment that distributes finely crushed dry coal to the bunkers with practically no dust loss at all.

In the housing is a Bartlett-Snow double strand flight conveyor, 80′ between centers, with 12″ x 36″ steel flights mounted on No. 678 drop forged heat treated rivetless chain. The conveyor operates at 85′ per minute, is driven with a 20 HP motor, and has capacity for about 200 tons per hour.

The fine dry coal is fed onto the flight conveyor from a belt conveyor (which is enclosed from the point at which it enters the building) and is discharged into the bunkers below through six 24″ x 30″ rack and pinion slide gates, opened and closed from the bunker floor.

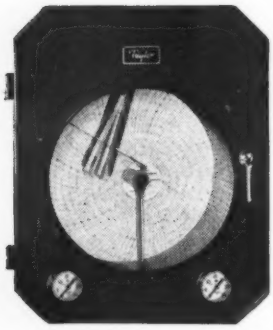
An exhauster system maintains a slight suction on the bunker, the flight conveyor and the end of the belt conveyor, assuring dust free operation. The exhauster discharges into a small cyclone separator shown at the left that returns the coal dust to the bunker and discharges the air into the stack.

Let the Bartlett-Snow engineers with their long and exceedingly successful experience in central station coal handling, work with you on your next coal handling job. The C. O. Bartlett & Snow Company, Cleveland 5, Ohio. Engineering representatives in New York, Baltimore, Detroit and Chicago.

BARTLETT-SNOW
CLEVELAND 5, OHIO

COAL HANDLING SYSTEMS
for
CENTRAL STATIONS AND INDUSTRIAL BOILER PLANTS

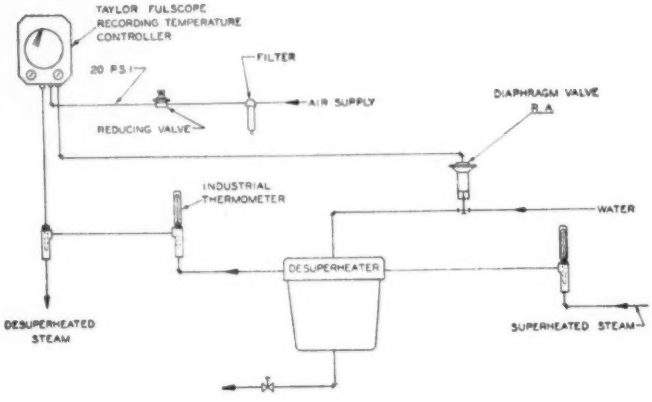
Desuperheater Control you need to protect vital equipment is right here



THIS is no time to let a desuperheater get out of control and damage or break down your other equipment. It *won't* when you have a Taylor Automatic Desuperheater Control System like this on the job. Here's how it delivers steam at the proper temperature.

Fulscope Recording Temperature Controller automatically maintains the proper temperature at the desuperheater outlet. It does this by controlling the valve on the water spray line to the desuperheater. That's all there is to it!

Ask your Taylor Field Engineer for complete details. In fact, ask him about other equipment problems that face you. He can give you a ready answer from our complete instrument line for better measurement or control of temperature, pressure, humidity, flow or liquid level. Get in touch with him today! Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.



Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

ARE YOU LOOKING FOR EXTRA QUALITY AND ENDURANCE IN HOSE?

SPECIFY ANKORITE HOSE FOR EVERY PURPOSE

Steam
Air
Water
Welding
Acid
Oil
Solvents
Creamery
and all other industrial uses!

Quality and *endurance* give Ankorite an edge over other hose . . . and these two advantages make Ankorite a "must" for industrial use everywhere. Furnished up to 50 feet in mandrel built wrapped construction. Continuous lengths in braided construction. For immediate delivery, adequate stocks carried at all warehouse locations. Let our nearest branch know your needs today.

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FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

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6052 PLANKINTON BUILDING.....MILWAUKEE 3, WIS.
5575 COTE ST. PAUL ROAD.....MONTREAL, CANADA
418 COMMON STREET.....NEW ORLEANS 4, LA.
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405 PENN AVENUE.....PITTSBURGH 22, PA.
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2207 FIRST AVENUE, SOUTH.....SEATTLE 4, WASH.
PEYTON BUILDING.....SPOKANE 8, WASH.
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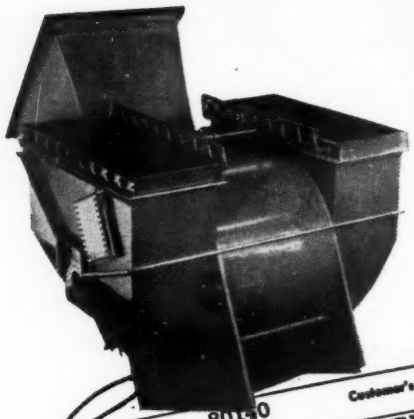
WHO BUYS *What?*

More evidence that American Blower Products—Mechanical Draft Fans, Fly Ash Precipitators and Gýrol Fluid Drives—maintain their popularity with old users while winning new users.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

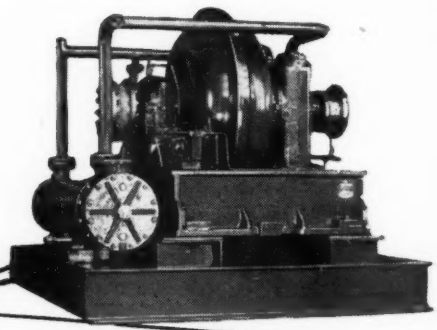
Division of American Radiator & Standard Sanitary corporation

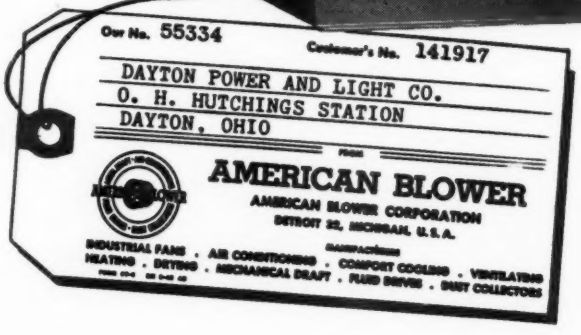


◀ **Sirocco Fans,** forward inclined blade type, are especially designed and proportioned for induced draft duty.

▲ **TYPE ST** Fly Ash Precipitator prolongs life of induced draft fans and alleviates air-pollution problem by collecting fly ash.

Type VS Gýrol Fluid Drive —for adjustable speed control of forced and induced draft fans ▼

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Customer's No. 141917
DAYTON POWER AND LIGHT CO.
O. H. HUTCHINGS STATION
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FROM
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MANUFACTURERS
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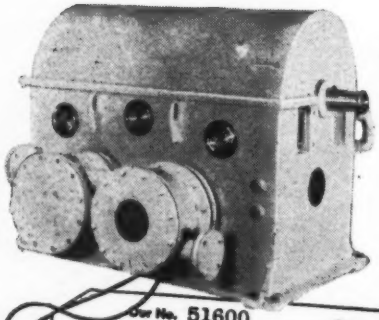

◀ **Type VS** Class 6 Gýrol Fluid Drive —for adjustable speed control of boiler feed pumps.

Our No. 51600
Customer's No. 46-E-149
PUBLIC SERVICE ELECTRIC & GAS CO.
SEWAREN STATION
SEWAREN, NEW JERSEY
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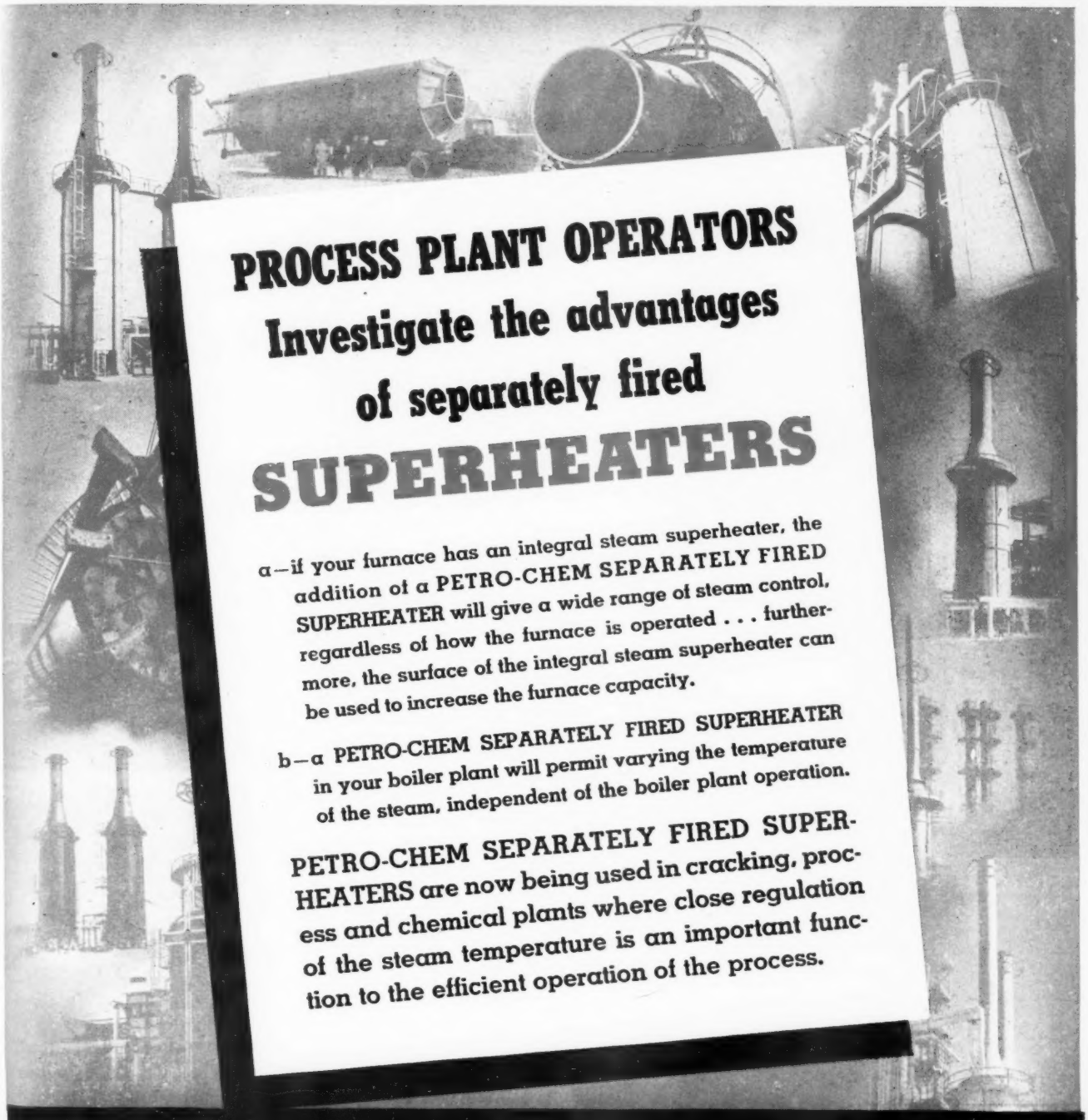
AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILER • ROSS HEATER • TONAWANDA IRON

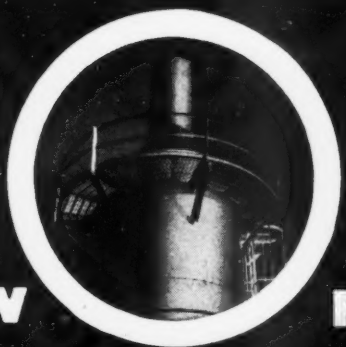


PROCESS PLANT OPERATORS
Investigate the advantages of separately fired
SUPERHEATERS

a—if your furnace has an integral steam superheater, the addition of a PETRO-CHEM SEPARATELY FIRED SUPERHEATER will give a wide range of steam control, regardless of how the furnace is operated . . . furthermore, the surface of the integral steam superheater can be used to increase the furnace capacity.

b—a PETRO-CHEM SEPARATELY FIRED SUPERHEATER in your boiler plant will permit varying the temperature of the steam, independent of the boiler plant operation.

PETRO-CHEM SEPARATELY FIRED SUPERHEATERS are now being used in cracking, process and chemical plants where close regulation of the steam temperature is an important function to the efficient operation of the process.



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ISO-FLOW FURNACES

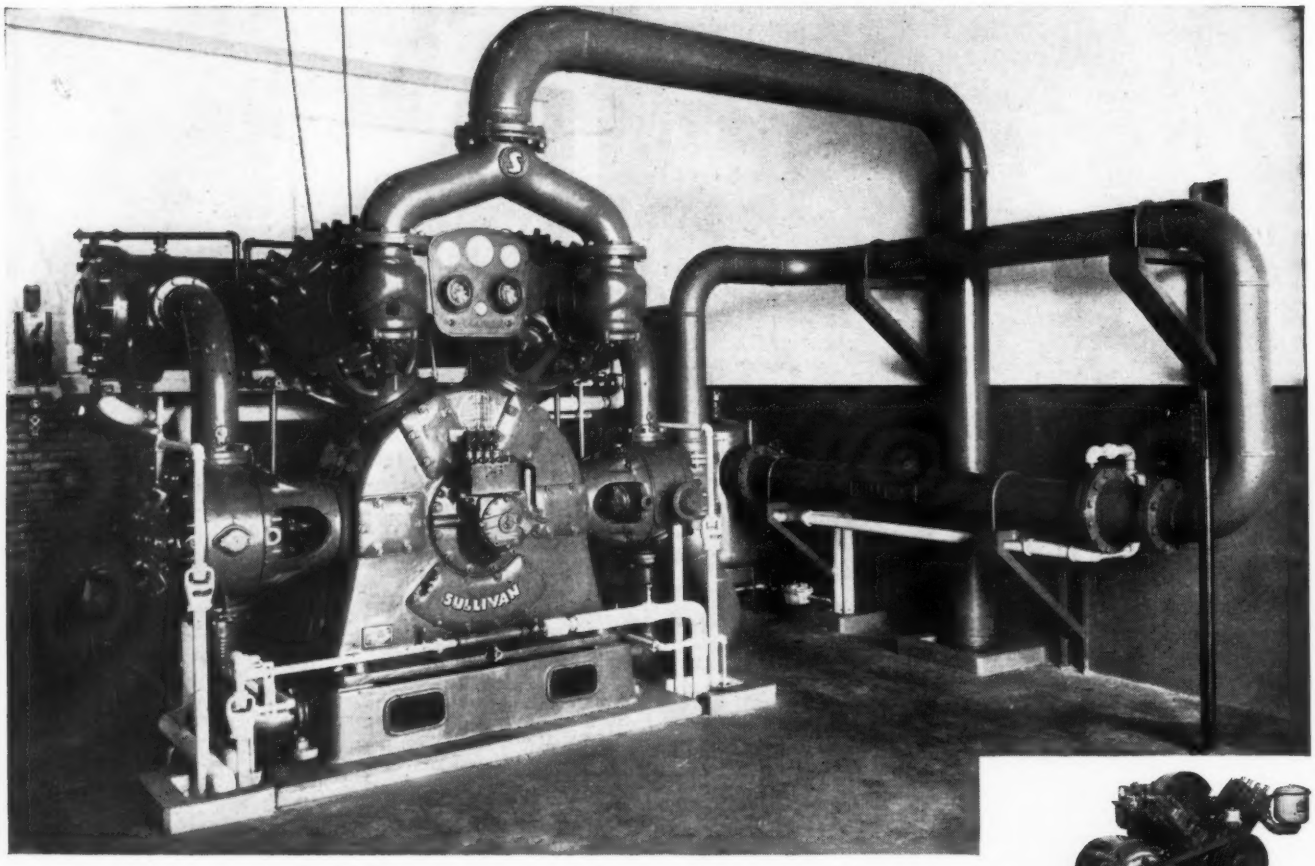
UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT CO., INCORPORATED

120 EAST 41ST STREET, NEW YORK 17, N. Y.

Representatives: Bethlehem Supply Co., Tulsa and Houston • Lester Oberholtz, Calif. • D. D. Foster Co., Pittsburgh • Faville-Levally Corp., Chicago

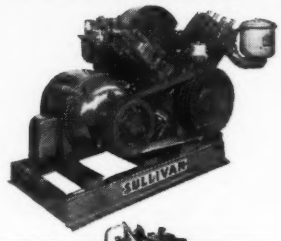
High Air Capacity . . . Unmatched in LOW AIR COST



JOY WN-114 COMPRESSOR

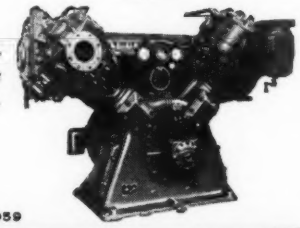
The JOY WN-114 is a four-cylinder, two-stage, double-acting compressor producing 1092 to 3656 CFM in single units, and up to 7312 CFM in twin units, depending on pressure. Exclusive "Dual-Cushion" valves provide top efficiency in low-cost air power. ● JOY builds the most modern compressors available for either centralized or decentralized air supply—*write for Bulletins.*

Consult a Joy Engineer



The JOY WL-80, in 9 sizes from 81 to 590 CFM.

The JOY WG-9, in 11 sizes from 153 to 822 CFM.



The JOY WN-112, in sizes from 378 to 1828 CFM.

W&D I 2059

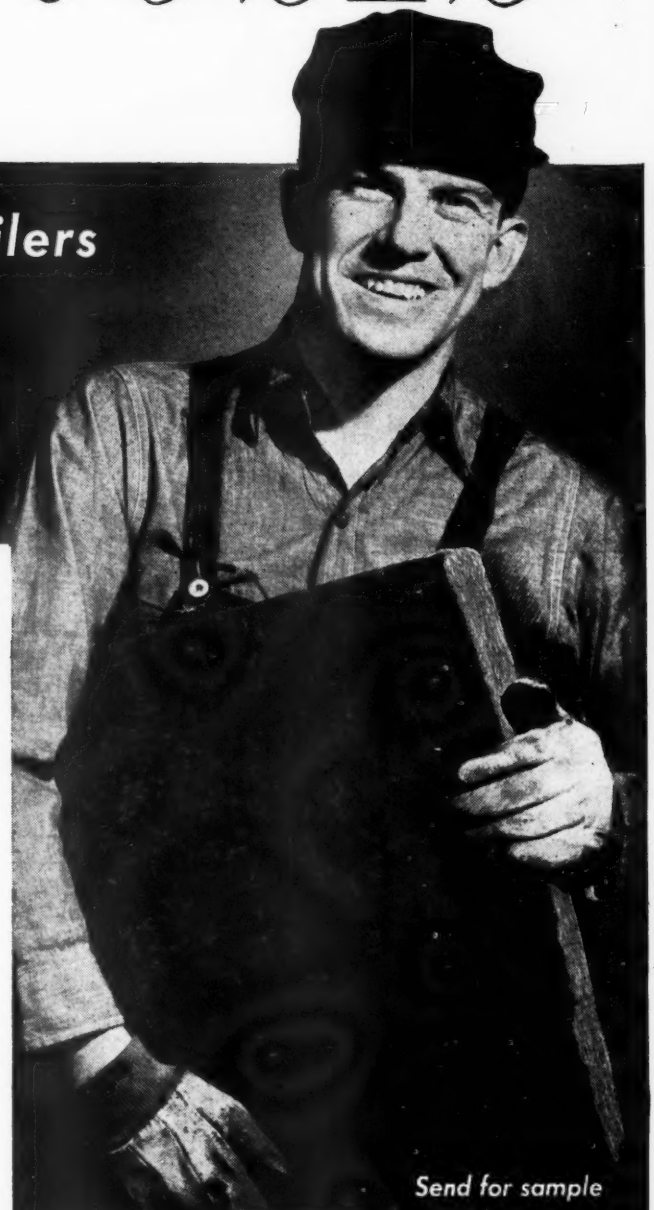
JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY-SULLIVAN OF CANADA, LIMITED, GALT, ONTARIO

CUT your COSTS

If you make or use boilers insulate with MONO-BLOCK!



Records show it! Today's buyers know it! In insulating boilers and processing equipment, you can make big savings on every job —using this one-block insulation that serves the full temperature range.

Savings in Material—Because Mono-Block is effective up to 1700 F., you eliminate the need for two types of block—make substantial savings in material alone.

Savings in Labor—Only one block to apply instead of handling a combination of blocks. B-H Mono-Block is light and resilient, cuts readily and fits snugly over rivet heads and other irregular surfaces.

Savings in Heat—B-H Mono-Block stops heat loss *with maximum efficiency*—because it's felted of long fibre *black* Rockwool. For example, conductivity of one inch thickness at 1000 F. is only 0.64 btu's per square foot per hour. Low alkalinity insures stability even under severe conditions.

Isn't it worth investigating? As a first step, send the coupon for a sample and descriptive literature.

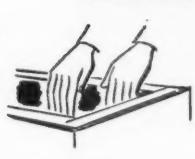
Baldwin-Hill

Specialists in Thermal Insulation

BH NO. 1 CEMENT

BH BLANKETS

BH WEATHERSEAL



BH FELTS

BALDWIN-HILL COMPANY
731 Breunig Avenue, Trenton 2, New Jersey

Send free sample of Mono-Block and 24-page data book "Industrial Insulations."

NAME .....

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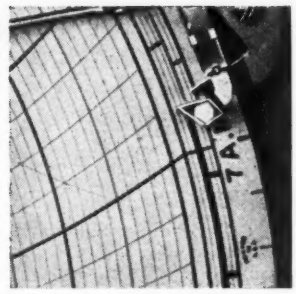
Is Your Steam Accounting System Just as Antiquated?

No one would think of firing a modern steam generator in this manner, but many plants are employing methods for approximating steam costs that are equally wasteful and outmoded.

With Brown Recording and Integrating Flow Meters, steam costs for power, processing and heating can be accurately determined—by departments or units and for every hour out of the 24. The dual chart record of rate and quantity immediately reveals any deviation from the most efficient operating standards.

Get the evidence of how steam cost savings are being effected in hundreds of plants. Write for Bulletin 2022—"Brown Flow Meters for Cost Accounting".

THE BROWN INSTRUMENT CO., 4490 WAYNE AVE., PHILADELPHIA 44, PA.
DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.
Offices in principal cities of the United States, Canada and throughout the world.



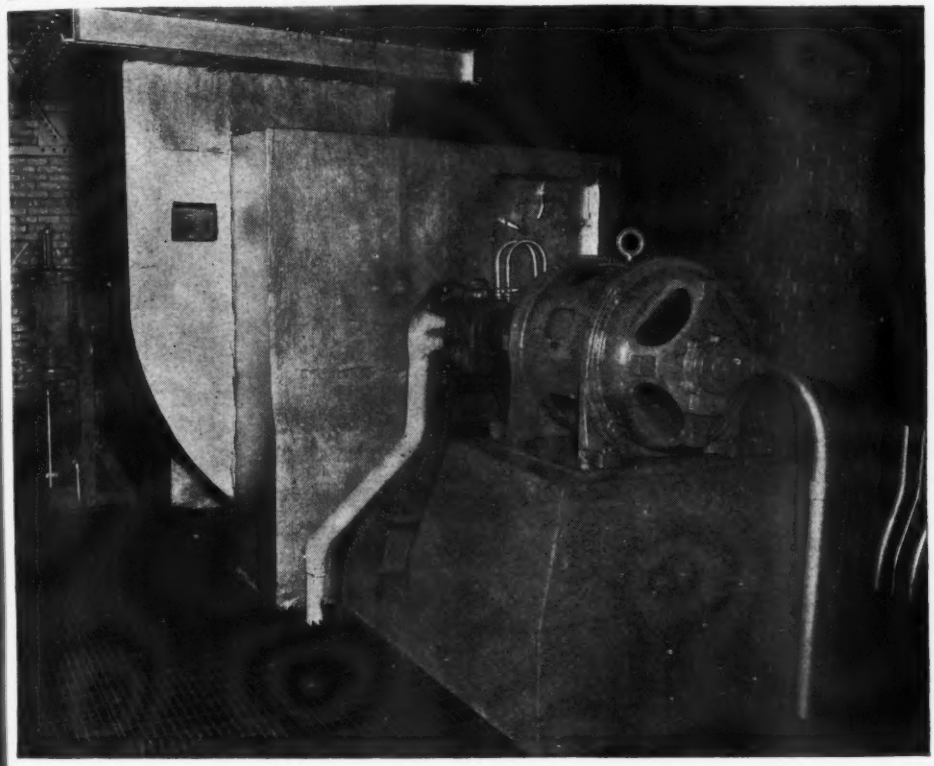
AUTOMATIC PLANIMETER. Records units of steam consumption on rim of chart. Shows steam used during any part of a 24-hour period.

INTEGRATOR. Totalizes steam consumption; gives the number of pounds used between successive readings.

BROWN *Cost Accounting* **FLOW METERS**
MINNEAPOLIS **Honeywell**

AIR EQUIPMENT TO HELP YOUR BUSINESS

Taking the "DRAFT MARATHON" *in stride*



– where "Buffalo" fans save money

As every power man knows, the boiler room is no place for a "weak sister" fan! That's why you make long-run savings when you specify "Buffalo" Forced and Induced Draft Fans—they're "scientifically husky"—built up in the right places to stand the grind.

The "Buffalo" Induced Draft Fan above is "taking it" on a 24-hour schedule in a well-known auto plant—as are similar fans in power plants all over the country.

We'd like you to see just *how much* endurance and efficiency are built into "Buffalo" Forced and Induced Draft Fans—and how this saves you trouble and money. *Write us for bulletins on your draft problem!*

BUFFALO FORGE COMPANY

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Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
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FAN ENGINEERING 5th Edition, offers you 808 pages of latest facts on air problems, including: fans, air flow, sound laws, heat, cooling, drying, air properties, humidity, air conditioning!

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FANS by "Buffalo"

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- ★ VENTILATING
- ★ HEATING
- ★ COMFORT COOLING
- ★ PROCESS COOLING
- ★ AIR TEMPERING
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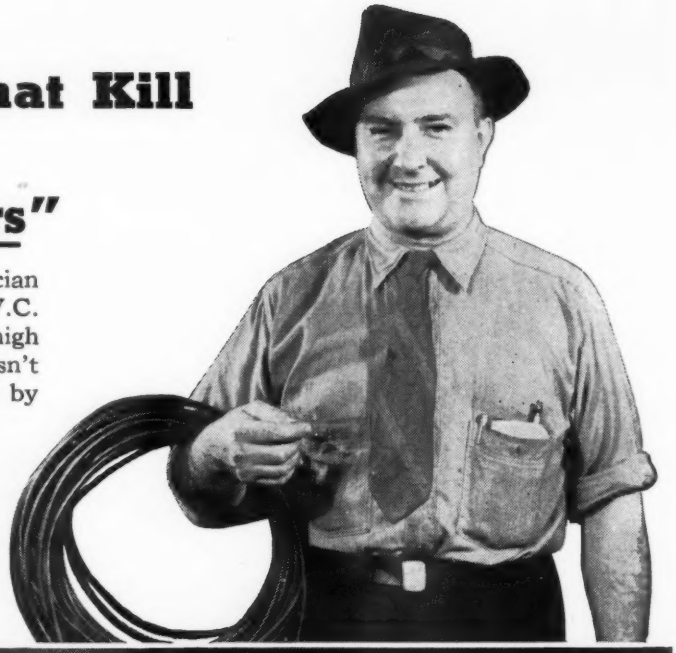
- ★ FORCED DRAFT
- ★ INDUCED DRAFT
- ★ PRESSURE BLOWING
- ★ CLEANING
- ★ DRYING

CUTTING AIR COSTS IN EVERY BRANCH OF INDUSTRY

"Under Conditions That Kill Ordinary Wire Fast, This Wire Lasts Years"



Says Mr. T. F. Bannon (right) Chief Electrician at Bird & Son, "Rockbestos 600 Volt A.V.C. lighting wire withstands the baking heat and high humidity our conditions impose on it. It doesn't bake brittle, crack or flow. It isn't damaged by the constant condensation. In short, it lasts years longer under these rigid conditions than we could hope for with 'ordinary' wire. I've used Rockbestos A.V.C. for over 20 years... and it hasn't ever fallen down on a job for me yet! What electrician could ask for more?"

In the paper plant of Bird & Son, inc., East Walpole, Mass., temperatures in this paper machine dryer hood run a constant 135° to 140° F., with relative humidity often as high as 65%. Conditions like these mean a quick end for lighting wire not specifically engineered to do the toughest jobs as dependably as the easiest ones. Which is why more and more alert plant men are turning to Rockbestos for sure performance under exacting conditions.

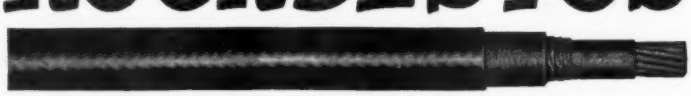
ROCKBESTOS PRODUCTS CORP.
NEW HAVEN 4, CONN.

NEW YORK CLEVELAND DETROIT CHICAGO
PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CAL.

Your copy of our new 96-page catalog is ready. Write for it.

PERMANENTLY INSULATED ROCKBESTOS WIRES AND CABLES

ROCKBESTOS



THE WIRE WITH PERMANENT INSULATION

next step is SANTOSITE

controls oxygen corrosion

To guard against corrosion and thus contribute to longer and more efficient service, new boiler installations should be protected from the start with Santosite (Monsanto Sodium Sulfite, Anhydrous, Technical).

When added to boiler feed water, Santosite removes all traces of residual oxygen—by combining with it to form sodium sulfate, which is water-soluble under boiler conditions.

Treatment with Santosite is simple. Merely maintain a residual of 30 parts to 1,000,000 parts of water—this also assures protection against the occasional appearance of oxygen caused by unexpected overloads, or leaks in condensers, pump packing glands and vacuum-return heating systems. No test for dissolved oxygen is required.

For complete application and technical data, send for a copy of Monsanto Technical Bulletin O-26, "Santosite for Removing Oxygen from Boiler Feed Water." Write to MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri, or ask for it on the coupon. *Santosite: Reg. U. S. Pat. Off.*

MONSANTO
CHEMICALS AND PLASTICS

MONSANTO CHEMICAL COMPANY PR-3
Organic Chemicals Division
1700 South Second Street, St. Louis 4, Missouri
Please send me a copy of the Technical Bulletin on Santosite.

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SERVING INDUSTRY . . . WHICH SERVES MANKIND

To everyone about to order unit heaters, Modine says,

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MODINE MAKES THIS SPECIAL OFFER

Get the facts *RIGHT ON YOUR DESK.* Call your Modine Representative today to show you an actual Modine Unit Heater . . . to explain its features in detail. You'll like its attractive appearance, sound engineering, rugged construction. Examine Modine — compare it with other unit heaters before you make your decision

Look at Modine Suspension!

See how this patented feature eliminates hanger-rods . . . speeds installation . . . lets you direct heat where you want it. Find out how it cuts installation charges up to $10 per heater.

Look at Modine Beauty!

Check Modine's clean, simple lines, beige-gray color, sparkling chrome trim. See how this attractive Modine appearance combines with quality Modine performance to give you the finest in unit heating today.

YES, look before you buy.. and you'll buy Modine!

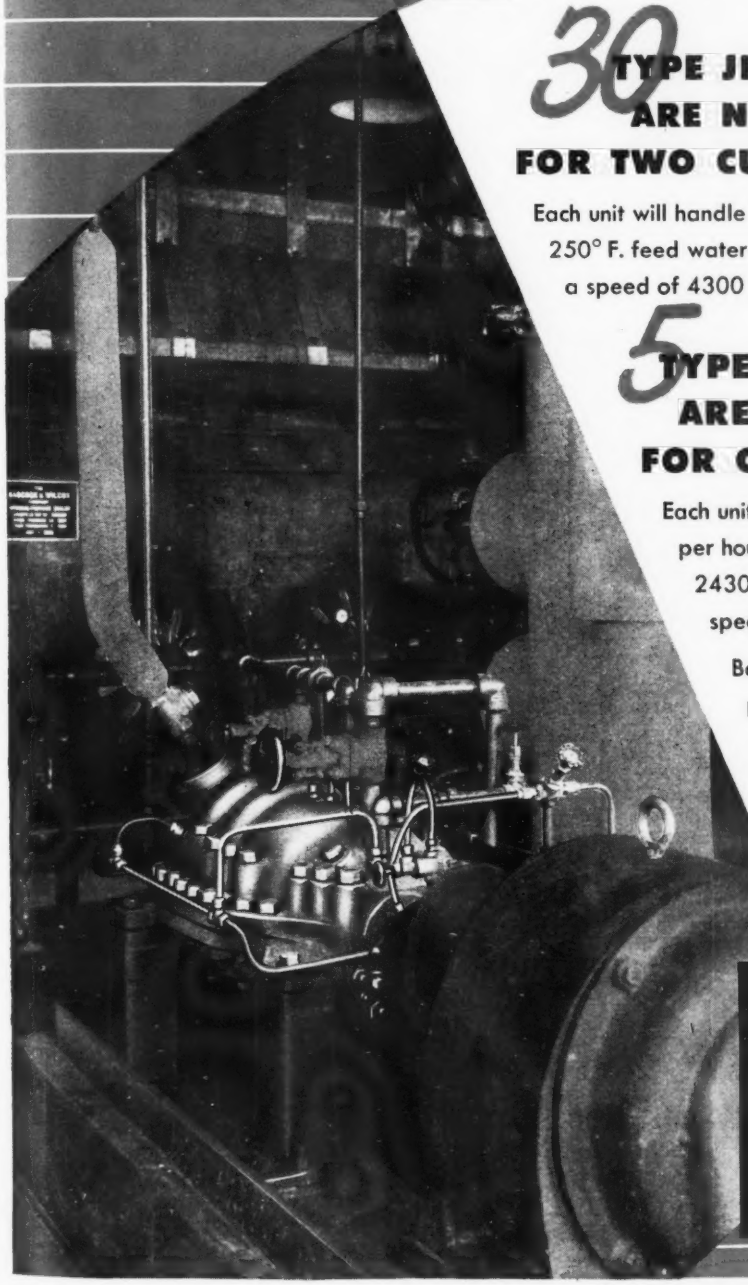
It's easy to see the difference between Modine unit heaters and all other makes. One look will show you Modine is the leader — the only unit heater which gives you ALL these important features. Modern Beauty. All-Copper Coils. Peak Performance. Easy Installation. Smooth Operation. What's more, you can choose from 3 types and 47 capacities to meet your specific heat, air delivery, height and location needs.

When you look before you buy, you'll see why Modine leads the field. Call your Modine Representative for further details. He's listed in the "Where-to-Buy-It" section of your phone book. Or write direct. Modine Mfg. Co., 1512 Dekoven Avenue, Racine, Wis.

Modine UNIT HEATERS

35 PACIFIC BOILER-FEED PUMPS

SPECIFIED BY THREE CUSTOMERS



30 TYPE JB PACIFIC PUMPS ARE NOW BEING BUILT FOR TWO CUSTOMERS

Each unit will handle 141,000 pounds per hour of 250° F. feed water with a 720 p. s. i. differential at a speed of 4300 r. p. m.

5 TYPE I PACIFIC PUMPS ARE NOW BEING BUILT FOR ONE CUSTOMER

Each unit will handle 800,000 pounds per hour of 344° F. feed water with a 2430 p. s. i. discharge at a speed of 3550 r. p. m.

Because of the outstanding performance of similar Pacific Pumps now in their service these three companies *specified* "Pacific" for their new installations.

WRITE FOR BULLETIN 82

PACIFIC *Precision Built* **PUMPS**

PACIFIC PUMPS INC., HUNTINGTON PARK, CALIF. • *One of the Dresser Industries*

BF-2

OFFICES IN ALL PRINCIPAL CITIES • Export Office: 122 E. 42nd Street, New York City

Now the Marsh line will include

Witt OXYGEN and WELDING Gauges

On September 30, the Witt Gauge Division of National Pressure Cooker Company was acquired by Jas. P. Marsh Corporation. As a result, the broad line of Marsh instruments will be still further broadened to include oxygen and welding gauges.

The Witt oxygen and welding gauges will be manufactured in the main Marsh plant by the "Witt Gauge Division of Jas. P. Marsh Corporation."

To users of oxygen gauges this is a significant development. It means that the respected quality of the Witt line will be further heightened by Marsh experience and the unmatched facilities of the new Marsh plant.

WITT GAUGE DIVISION OF

JAS. P. MARSH CORPORATION

DEPT. F, SKOKIE, ILLINOIS

Ready power for the PETROLEUM INDUSTRY with WICKES TYPE-A water tube boiler

Designed for efficient steam generation, Wickes Type-A water tube boilers are now in use in the nation's leading oil refineries. Three proved advantages make this Wickes unit *the most efficient of its type:* 1) — It has twice the black surface of the average boiler; 2) — Combustion gases travel through staggered rows of tubes, assuring high operating efficiency under varying load conditions; 3) — Two simple U-tubes with no excessive resistance, *insure positive water circulation* necessary to high heat absorption. • Wickes Type-A Water Tube Boilers are made in capacities to 200,000 lbs. steam per hour, with pressures up to 850 lbs. psi. Drums welded to A.S.M.E. standards. *Write for descriptive catalogue.*

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DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

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A Cottrell Precipitator Installed by Research Corporation

WILL COLLECT OVER

95%

OF YOUR FLY ASH

A Research Corporation Cottrell will effectively clean stack gases by removing over 95% of all the different size fly ash particles suspended in the gas.

It will operate with a low draft loss, averaging only a few tenths of an inch of water across the Cottrell. The electrical power required for energizing the Cottrell is extremely low, amounting to only .5 to 1.0 KWH per 100,000 cubic feet of gas cleaned.

The *plus* efficiency of Research-installed Cottrells is assured by Research's experience gained in over 35 years and 1100 installations. This knowledge is essential to successful dust control, for every application presents its own peculiar problems. Each installation must be individually engineered.

Research-Cottrells can be installed to furnish any degree of efficiency desired, and to handle any volume of boiler gas. Full information is presented in an interesting 28-page bulletin. Write for your copy today.

Research Corporation Installations

47 CARBON BLACK PLANTS
200 METALLURGICAL INSTALLATIONS
203 ACID PLANTS • 34 PAPER MILLS
262 DETARRING INSTALLATIONS
195 POWER STATIONS
71 STEEL PLANTS • 95 OIL REFINERIES
AND MISCELLANEOUS INSTALLATIONS

RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois

Welded piping at Capital City Products Co., Columbus, Ohio

Hercules would have needed help

HOLDING together Dowtherm-jacketed steam lines would have been too tough for the mythical strong man of yore . . . even for a little while. But, at Capital City Products Company, Columbus, Ohio, Tube-Turn welding fittings have been doing just that—*for eleven years*!

There are good reasons why Tube-Turn welding fittings have successfully weathered eleven years of service on the piping shown above. The welded joints are permanently leakproof and form a continuous metal structure with the pipe. Forged-in strength gives them the ability to take punishment for years with little maintenance. Insulation—easy to apply—need never be removed because of joint failure. Full effective radius and smooth inner walls reduce friction and erosion, minimize pressure loss.

For the utmost in strong, dependable piping connections, remember "Tube-Turn", the No. 1 trade name in welding fittings. Your Tube Turns distributor has a large stock in a wide range of types, sizes, metals, and alloys. For good service in good connections, specify "Tube-Turn".

TUBE TURNS, INC.

236 E. Broadway, Dept. C, Louisville 1, Ky.

District Offices at New York, Philadelphia, Pittsburgh, Chicago, Houston, Tulsa, San Francisco, Los Angeles

Write for the new and revised Tube Turns' chart of "Pipe and Fitting Materials". Covers ASTM and other specifications, chemistry, service temperature limits, welding data.

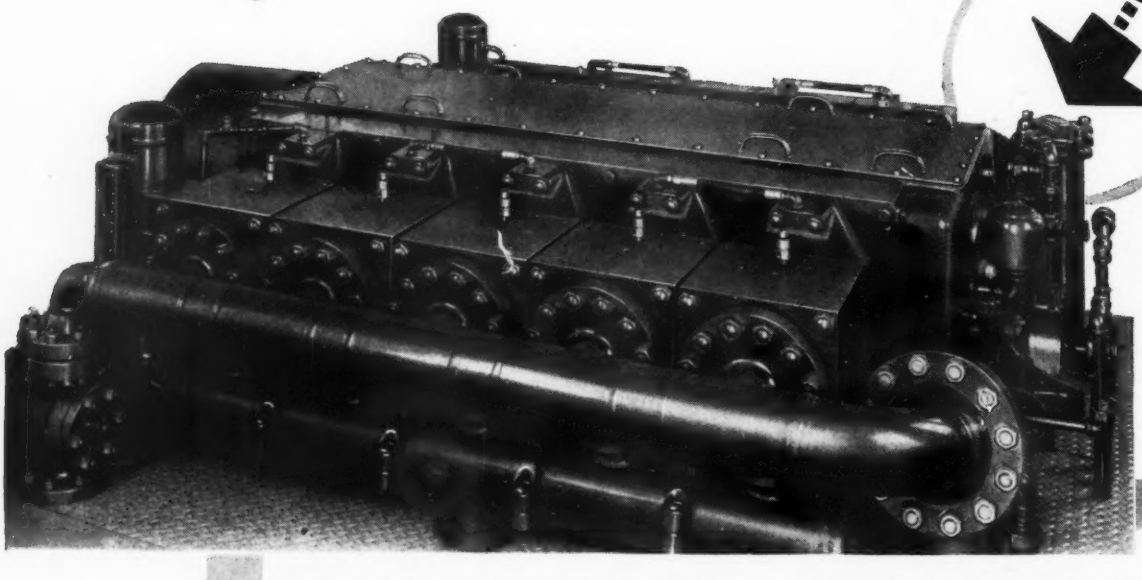
TUBE-TURN

WELDING FITTINGS AND FLANGES

One way to spot quality

. . . look for

Nugent Filters



A manufacturer who designs his product for long, dependable service realizes that one of his best assurances of satisfactory performance is a lubricating oil filter which will provide a constant supply of clean oil. Nugent lube oil filters do just that—by removing dust, grit, fibres, carbons and discolorations from lube oil, in particles as small as a few microns—and they do it 20 times longer without interruption than other filters of comparable size.

The lube oil filter shown above is a Nugent Depth-Type Pressure Filter installed on a new Cooper-Bessemer Twin-Line Liquid Pump. Filters of this type use either the repackable or the inexpensive, replaceable "THROWAY" filter cartridges. You can get single filter units containing from one to twelve cartridges made for capacities up to 182½ GPM, depending upon your requirements.

Nugent Lube and Fuel Oil Filters have been specified for a wide variety of installations, a few of which are diesel locomotives, naval and commercial vessels, stationary engine plants, and steel mills. Ask to have a Nugent engineer study your filtering problems, and recommend the type of Nugent filter best suited to your needs.

NUGENT TRADE MARK Est. 1897

Wm. W. Nugent & Co., Inc.

402 N. Hermitage Ave. CHICAGO 22. ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

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Accept no less than the FULL LINE!

Whatever the conditions: Extreme temperatures . . . . extreme pressures . . . . steady flow or shock service . . . . corrosion resistance . . . . product purity.

Whatever the material: Forged carbon steel . . . . wrought iron . . . . carbon or chrome moly . . . . Stainless 304, 347, 316 . . . . Monel . . . . Nickel . . . . Inconel . . . . Aluminum . . . . other usual industrial materials.

Whatever the size or weight: Forge-formed fittings in the entire size range from ¾" all the way to 30" (or larger!): in all the usual or special weights necessary for *any* service condition; with a companion range of seamless forged and forge-rolled flanges of every type, in *all* ASA sizes and pressure series, or beyond, as large as 96" diameter.

Whatever your requirement: Taylor Forge provides the most complete line. Accept no less!

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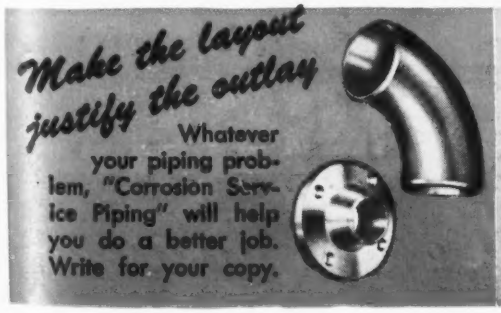
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Whatever your piping problem, "Corrosion Service Piping" will help you do a better job. Write for your copy.

Send me "Corrosion Service Piping"

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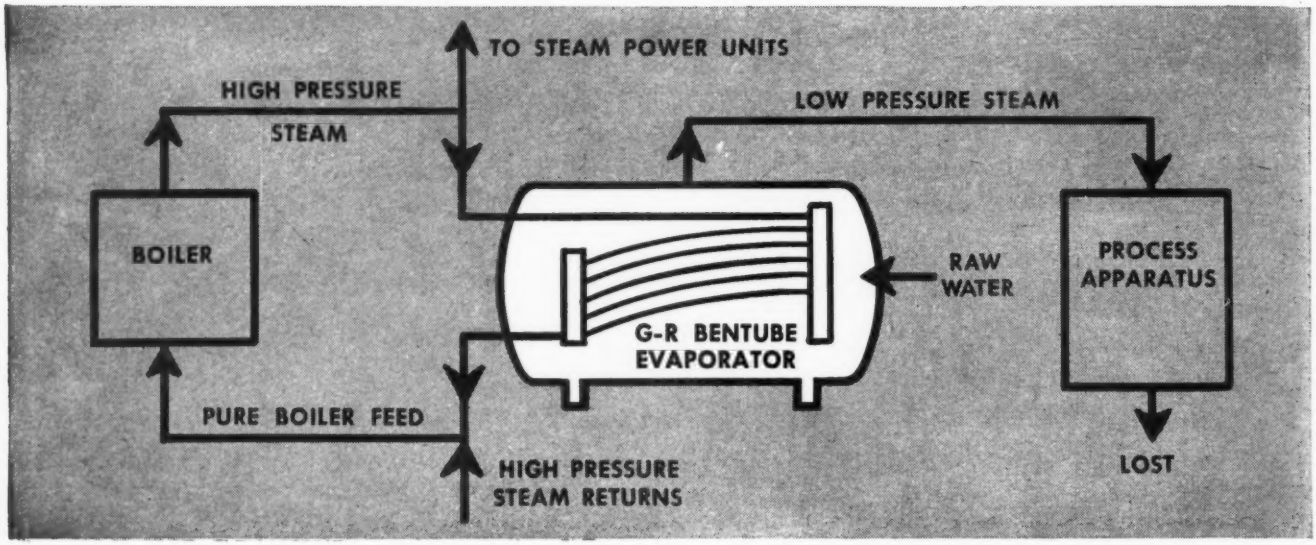
HOW you can obtain PROCESS STEAM efficiently.



Bulletin 366 explains the various methods of associating evaporators with the plant heat balance and describes in detail the designs and special features of G-R Evaporators. Write for your copy.

A G-R Bentube Evaporator uses steam from high pressure sources to produce lower pressure steam for process work. The high pressure steam which operates the evaporator is all returned to the boiler, after use, in the form of condensate. Therefore, no raw, scale-forming make-up or contaminated drains from steam used in process is fed to the boiler, thus reducing boiler maintenance.

Raw untreated water can be fed to the evaporator producing the process steam. G-R Bentube elements of scale-shedding design make possible the use of raw water because they maintain rated heat transfer without requiring hand scaling.

The G-R Bentube Evaporator used in this service operates as a practically 100% thermally efficient reducing valve, and ideal plant heat balance can be arranged.

Many millions of pounds per hour of process steam are now being produced in highly successful G-R Bentube Reducing Valve Evaporator plants. Investigate this economical method of obtaining process steam for your plant.

THE GRISCOM-RUSSELL CO.
285 MADISON AVENUE, NEW YORK 17, N. Y.

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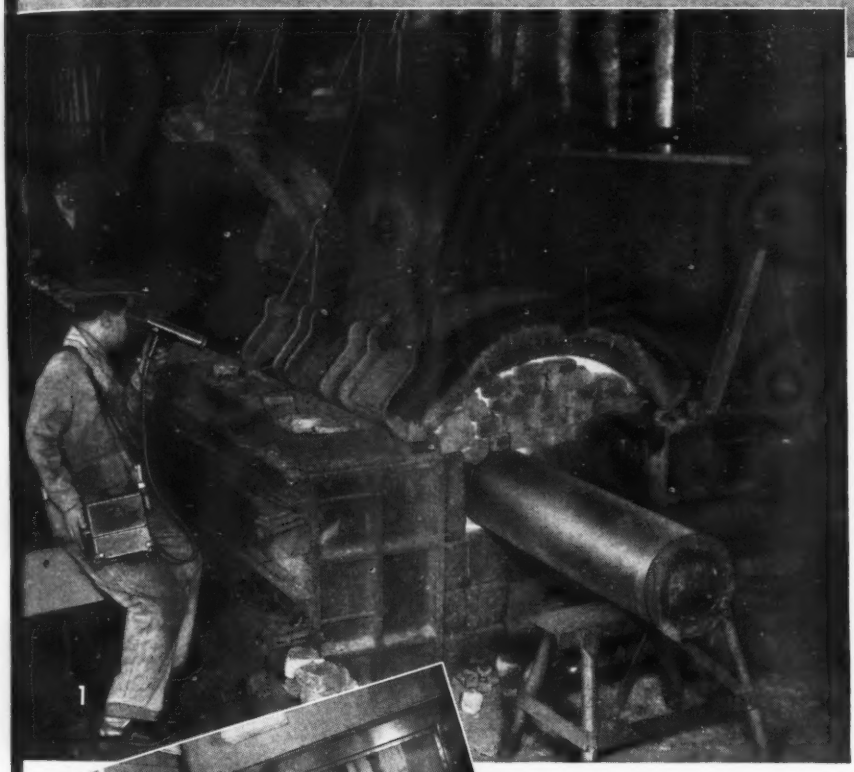
Pioneers in Heat Transfer Apparatus

MAGIC EYES

WATCH EVERY STEP



Complete instrumentation is essential in bending and fabricating complicated assemblies of piping to carry high pressures and extreme temperatures. So complete instrumentation, along with much other special equipment, is provided in Blaw-Knox Power Piping shops.

Here, each step in fabrication is closely guarded by the magic eyes of instruments that detect or prevent flaws not visible to unaided human eyes.

However big and tough the power piping problem may be, Blaw-Knox Prefabricated Power Piping meets it with care, experience and the right tools for the job.

POWER PIPING

Division of
Blaw-Knox Construction Company
1525 Pennsylvania Ave., N. S.,
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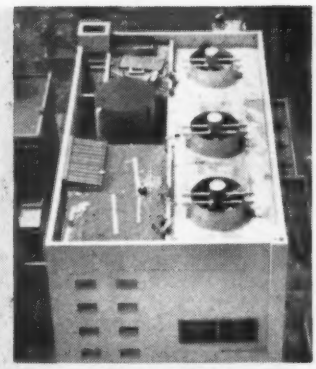
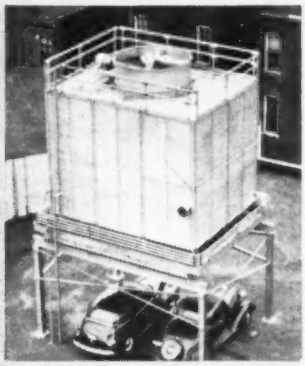
2. Thermocouples and automatic temperature regulators control annealing furnaces.
3. Microscopic inspection checks grain size before and after annealing.
4. Temperature indicators govern welding preheat and stress relieving operation.
5. Final inspection is made with modern X-ray machines.

BLAW-KNOX

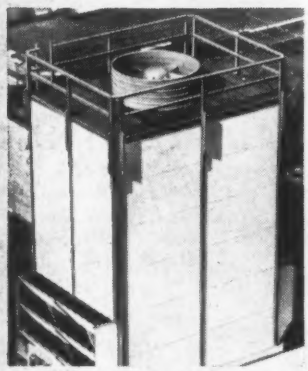
POWER PIPING



NEW YORK *



ST. LOUIS *



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HOLLYWOOD *

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PRITCHARD COOLING TOWERS
Operate Economically and Efficiently

Across the nation, Pritchard has solved the water cooling problems of many air conditioning and refrigeration installations. Broad engineering experience enables us to meet your space limitations and foundation requirements. Our complete line of "fire zone" towers includes:

Steel frame—masonry exterior
Steel frame—steel exterior
Redwood frame—asbestos-cement exterior
Redwood frame—steel exterior

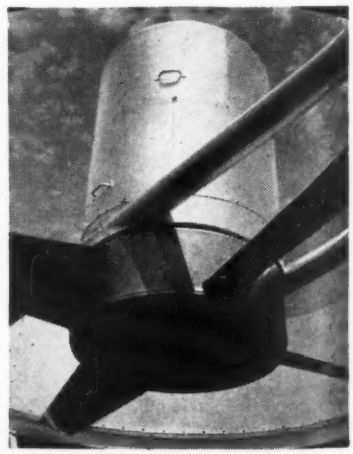
Each is designed for its specific job. Fan drives selected for most efficient application—V-belt drives, right angle speed reducer drives, direct motor-fan drives and the patented Pritchard SEALDFLOW are all available.

For complete information on cooling towers and other Pritchard services, consult our nearest office or see Sweets Files, ASH & VE Guide, ASRE Data Book and other catalogs.

** Names of owners of Pritchard cooling towers in air conditioning and refrigeration service in these cities—and many more in between—will be gladly furnished.*

SEALDFLOW

Pritchard's patented self-ventilated SEALDFLOW fan drive (as illustrated at right) mounts the motor and gears directly on the fanshaft for highest efficiency and complete protection from corrosive action of saturated vapors. Investigate this time-proven, trouble free fan drive! It may be the answer to the mechanical problems on your present tower.



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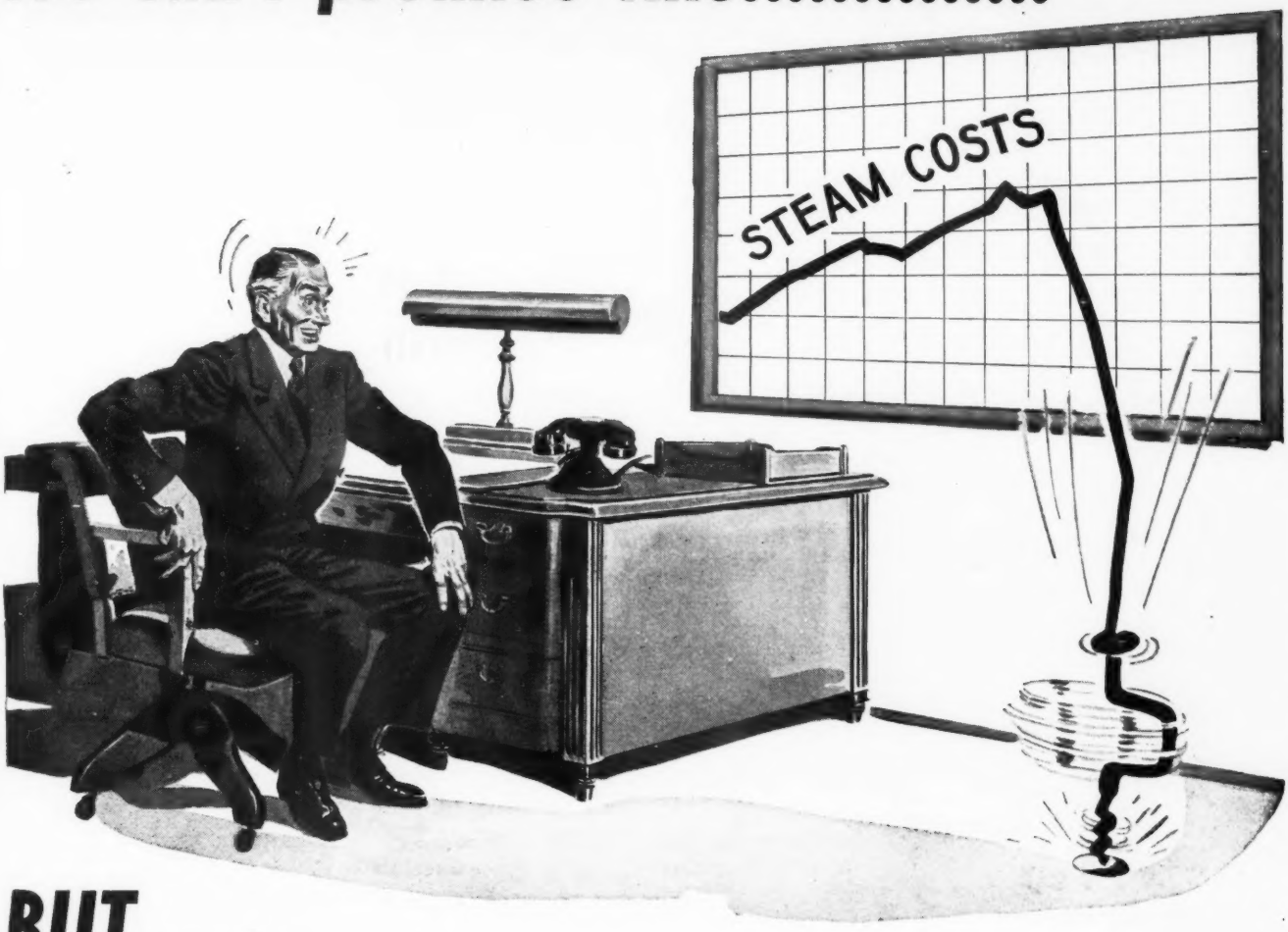

BUT.....

We *can* promise you low steam costs. Savings of as much as 20% can often be realized by replacing a conventional 14-year old boiler with a modern Preferred Unit Steam Generator.

WHY? Because the Preferred packaged power plant is the *only* factory-completed unit steam generator with *all* these money-saving features:

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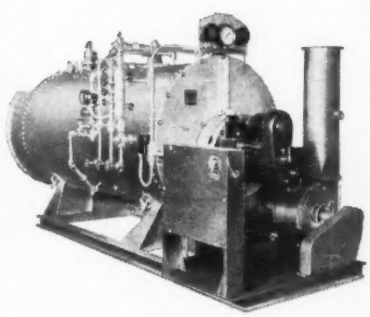
5. 80% Thermal Efficiency proved and guaranteed.

6. Low Maintenance, the result of over 27 years of combustion engineering experience.

7. Full Range of Sizes—from 20 to 500 h.p. and pressures of 15 to 200 lbs. Two-pass units in 20 and 30 h.p. with pressure of 15 lbs.

Four-pass units also available in all sizes for 250 p.s.i.g. design on special order. Write for complete details of these special units.



These features add up to lower fuel costs, minimum repair bills and the elimination of costly, unexpected shutdowns for those who replace their old boiler with a modern Preferred Unit Steam Generator.

Two Booklets giving the inside story on Preferred steam generation are yours for the asking. "*Dividends From Your Power Plant*" tells the "profit side" of the story in 36 fact-filled pages written especially for management. Bulletin 1000E gives the *engineering* details on these money-saving units.

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Combines with 5 Erie City Boiler-Furnace Units

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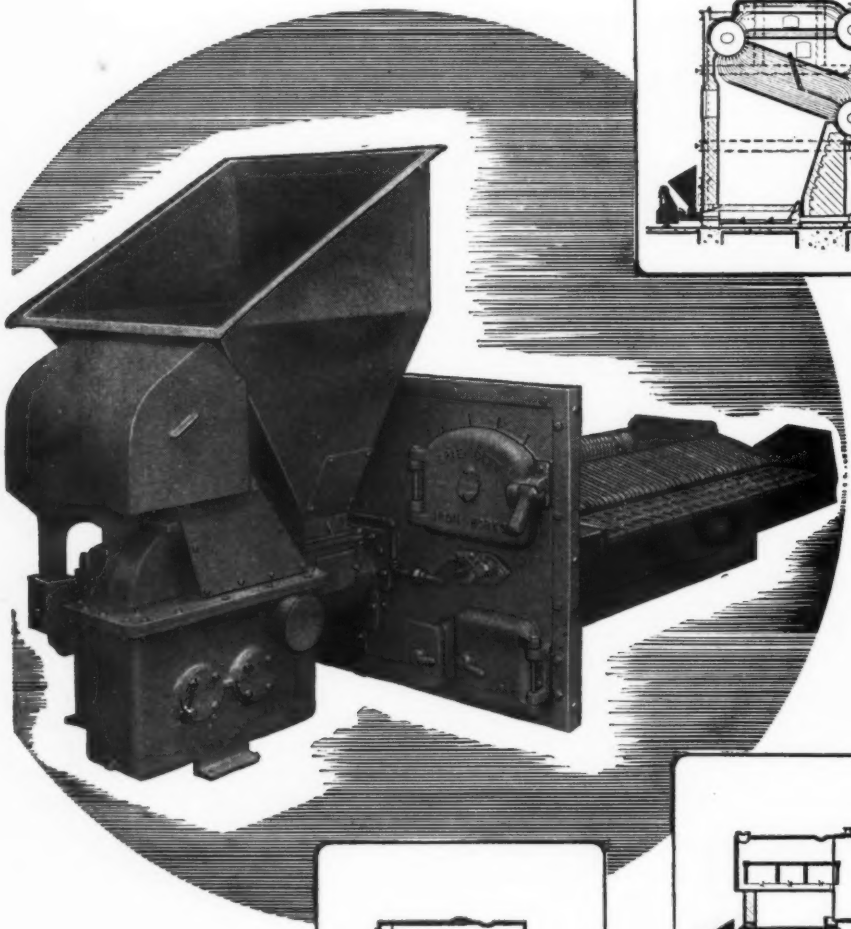
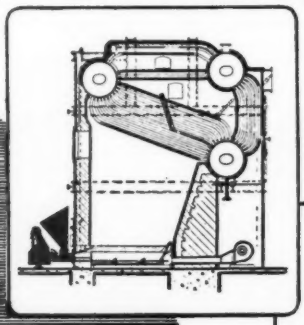
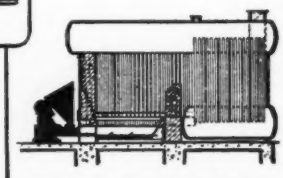
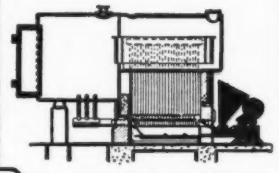




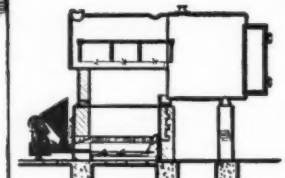
Erie City Underfeed Stoker firing Erie City Type C 3-Drum Boiler



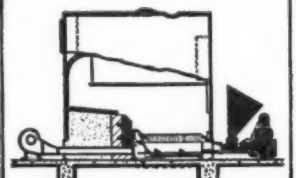
Erie City Underfeed Stoker firing Erie City Type VL Boiler



Erie City Underfeed Stoker firing Erie City Water Wall Economic



Erie City Underfeed Stoker firing Erie City Standard Economic



Erie City Underfeed Stoker firing Erie City Heating Boiler

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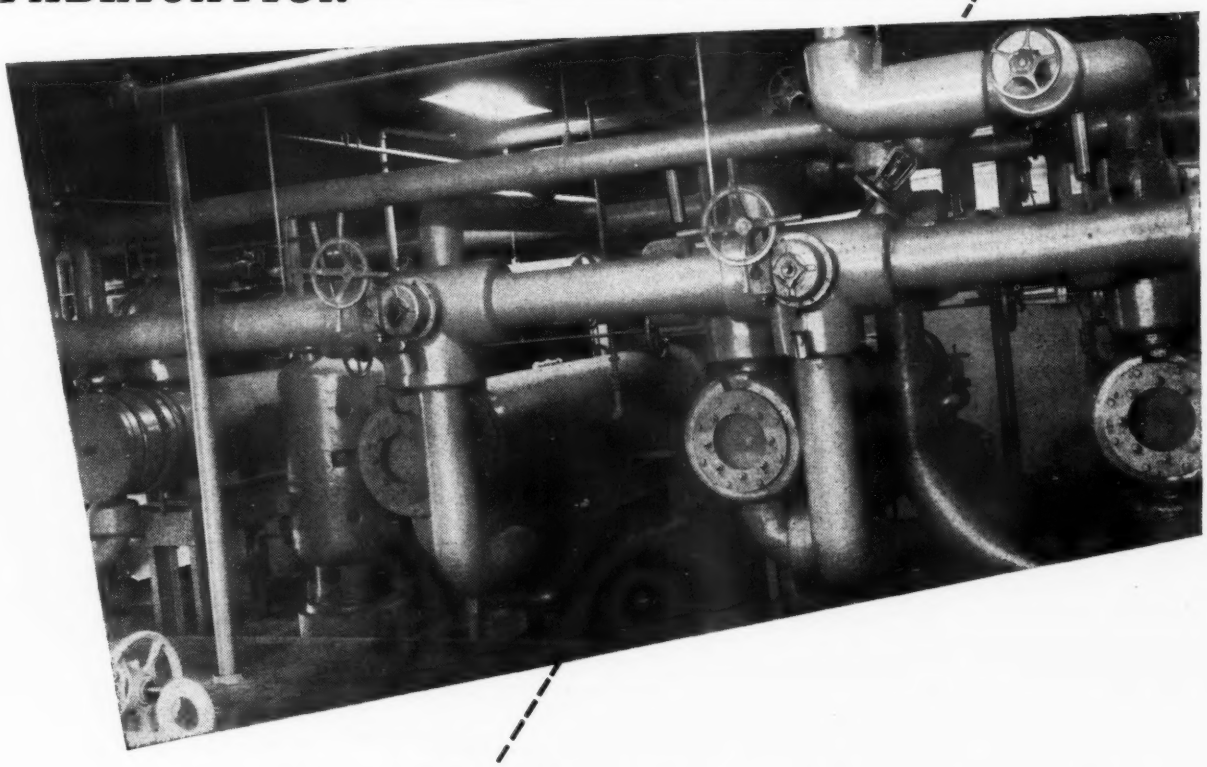
PROVIDE EFFICIENT THERMAL DESIGN, RELIABLE MECHANICAL DESIGN, AND SOUND FABRICATION



The above feedwater heaters were installed in one of the most progressive of our west coast municipal power plants eight years ago. In the two subsequent additions, Struthers Wells Feedwater Heaters have been used.

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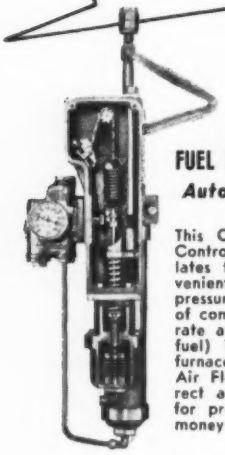
AUTOMATIC REGULATION OF FUEL FEED

METERED AIR NEEDED FOR COMBUSTION

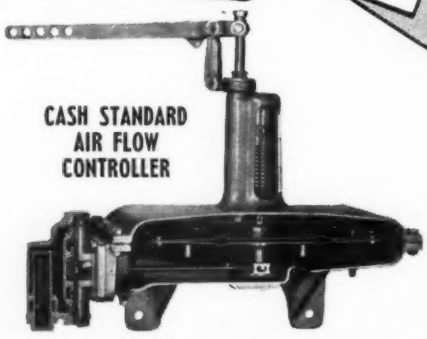
A CONSTANT DRAFT MAINTAINED IN THE COMBUSTION CHAMBER



CASH STANDARD FUEL FEED CONTROLLER . . .

Automatically Regulates Fuel Feed

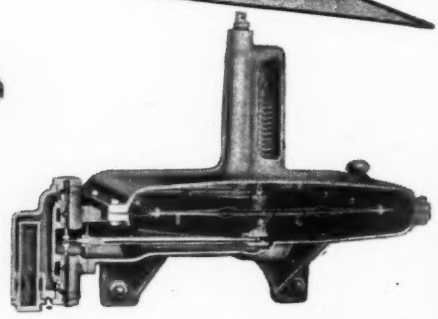
This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.



CASH STANDARD AIR FLOW CONTROLLER

Meters the Air Needed for Combustion

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.



CASH STANDARD FURNACE DRAFT CONTROLLER

Maintains a Constant Draft In the Combustion Chamber

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.

THERE'S YOUR *Answer* TO GREATER COST SAVINGS IN YOUR BOILER ROOM . . .

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

You get the cost savings three ways—(1) Less fuel—coal—oil—gas required. (2) Less maintenance requirements whether you have a single boiler or battery of boilers. (3) You get more steam from your present boiler.

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Bulletin No. 300
shows applications—tells how the system works in your favor.

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View of boiler front from air-conditioned Control Room in the efficient and modern Industrial Canal Station of the New Orleans Public Service. Shown here are six of the 18 modern Peabody H-26 Combination Gas and Oil Burners installed in this new plant.

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One of America's newest and most efficient power-generating plants is the new Industrial Canal Station of the New Orleans Public Service. Eighteen modern Peabody H-26 Combination Gas and Oil Burners are installed in this plant to handle 90,000 lbs. of oil or 1,597,000 cu. ft. of gas per hour, *interchangeably,* and generate more than 1,200,000 lbs. of steam per hour! At this high fuel-firing rate, maximum efficiency is imperative — that's why New Orleans Public Service, like other leading Public Utilities, specified Peabody Burners . . . the standard of efficiency for more than 20 years.

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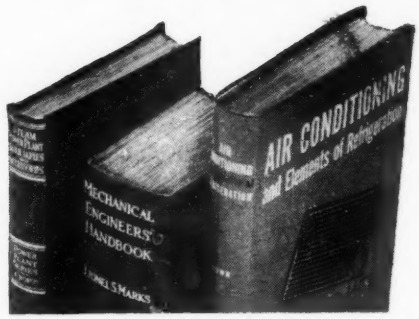

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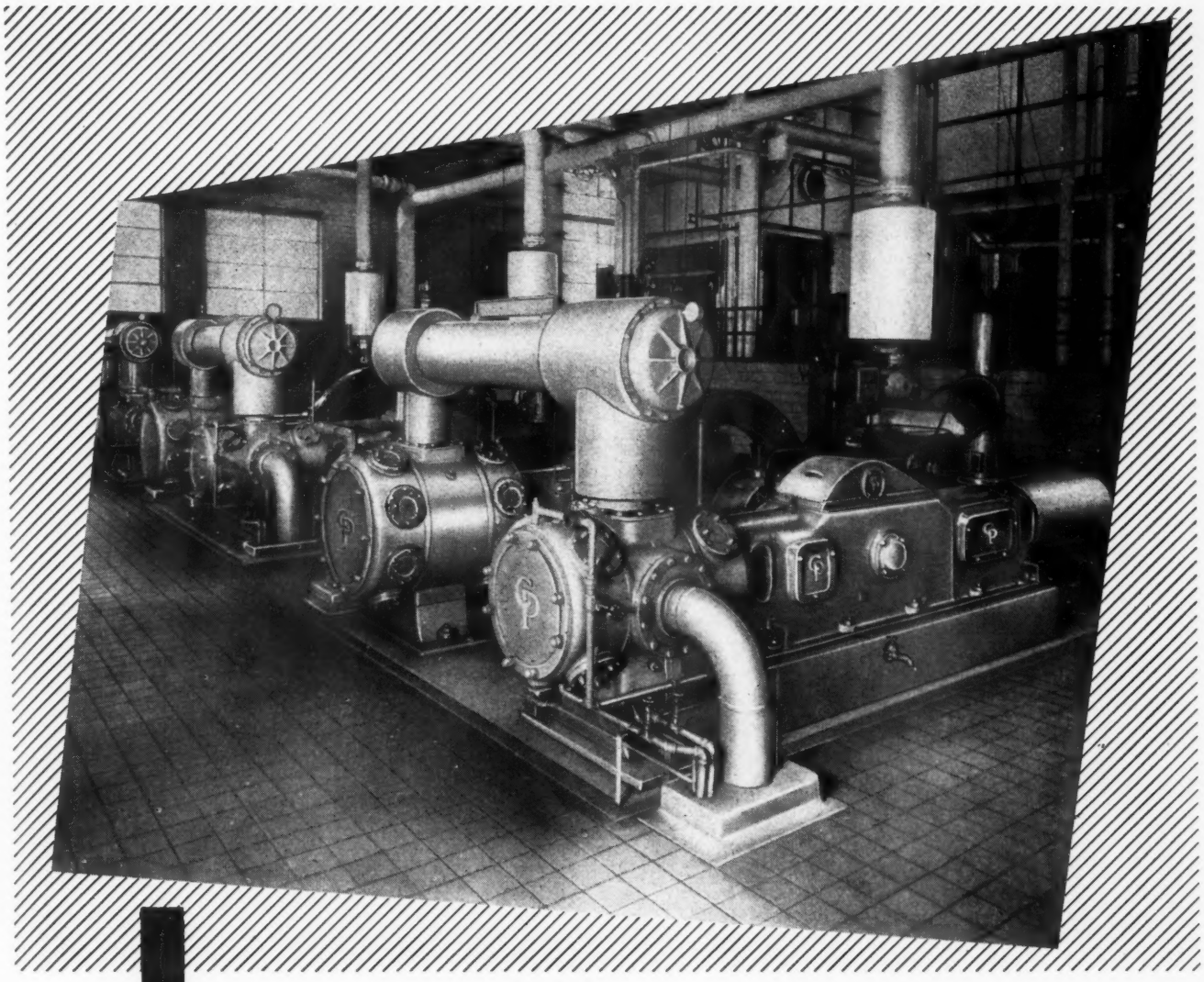

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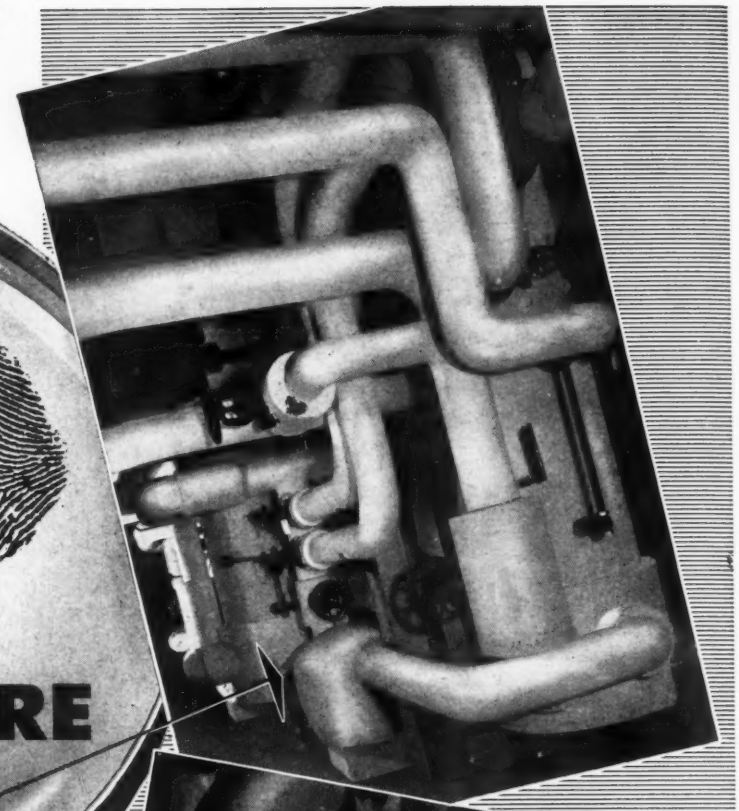

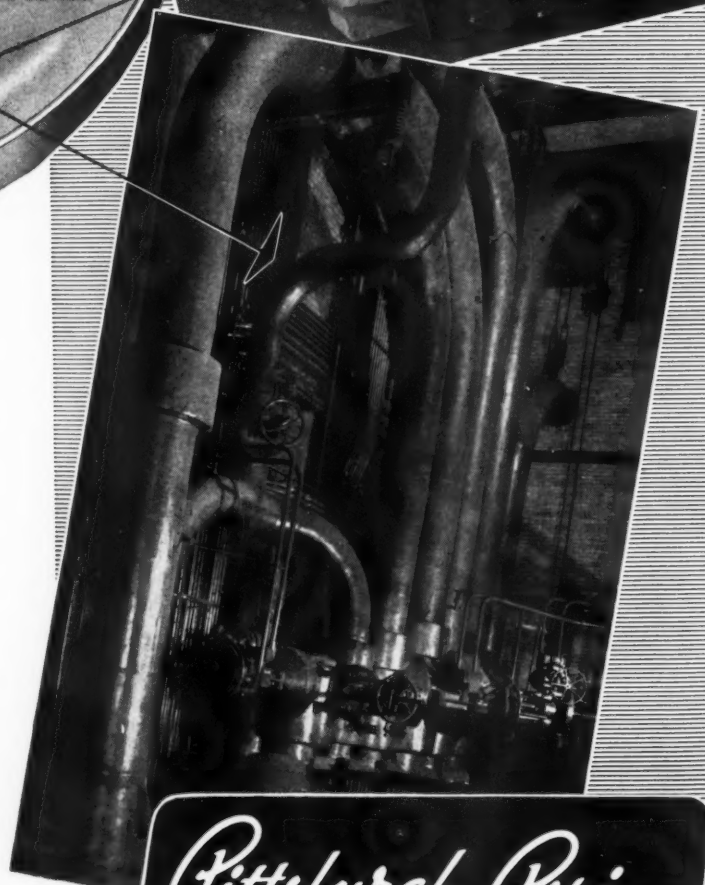

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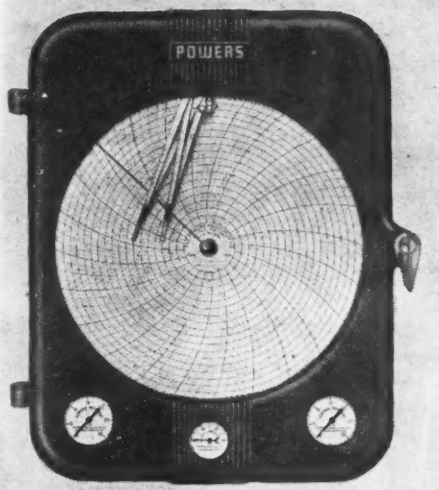
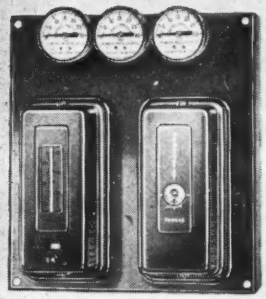
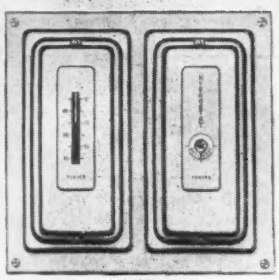


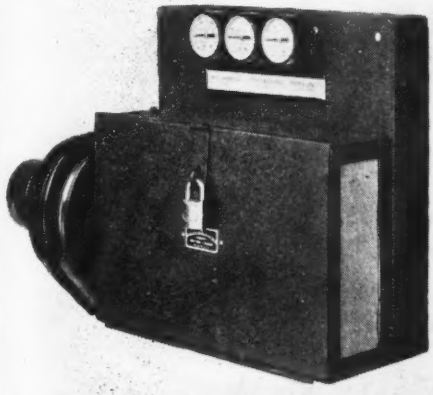
POWERS WET and DRY BULB RECORDER REGULATOR

At Right
HYGROSTAT and THERMOSTAT COMBINATION for Exposed Piping
•
Below
HYGROSTAT and THERMOSTAT for Concealed Piping





Below—Powers Aspirator Box containing Hygrostat and Thermostat over which is drawn, by suction fan at left, a stream of air filtered by fine screens. Widely used in Textile Mills and suitable for other industries.



Only a few of our many different types of Humidity Controls are shown here. For further information phone or write our nearest office.

HY2

Above
ROOM HYGROSTAT
for Concealed Piping
At Left
ROOM HYGROSTAT
for Exposed Piping • Above DUCT HYGROSTAT

POWERS Type 190 HYGROSTATS

may help solve one of your difficult problems

POWERS new type 190 Hygrostat is pneumatically operated and sensitive to the slightest changes in relative humidity. Users state "it is the most accurate hygrostat made."

Controls valves or dampers in connection with heating or cooling coils, humidifiers, air washers, humidifying atomizers, spray nozzles, etc.

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Points of Superiority: 1. Precise control and quick acting response to slight changes in relative humidity. 2. Reliable operation and maintenance of calibration over long periods of time. 3. Modern design, compact and efficient. 4. Sensitivity adjustment. 5. Unusual resistance to vibration. 6. Requires a very small amount of compressed air for its operation. 7. Easy to install.

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Whatever size Trimo-Alloy Pipe Wrench you need, buy and use, you get "oversize" power and durability—because it's the only wrench on the market that is entirely made of drop forged alloy steel. The teeth are hardened by modern induction heat-treatment—and the whole wrench is tough in the right places to stand tremendous stress. Trimos are the most powerful wrenches ever built for industry. Put them to work wherever other wrenches are found wanting.

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DIVISION OF AETNA INDUSTRIAL CORP.
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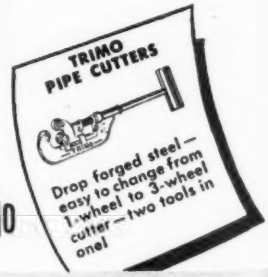
EVERY PART IS GUARANTEED

- Trimo Alloy Pipe Wrenches are made to exceed Government Specifications.....Type II Heavy Duty.....GGG-W-651a.
- Only Trimo Pipe Wrenches are manufactured throughout from alloy steels.
- Only Trimo Wrenches have teeth hardened by modern induction localized heat-treating process to close Rockwell specifications.
- Tests prove Trimo drop-forged steel handle capable of bearing strains up to 40,000 inch-pounds — more than double that of cast malleable handles in same size wrench.
- Trimo's frame design is on the efficient "knee-action" principle — making possible one-hand use on otherwise two-hand jobs.
- Replaceable lower jaw saves buying complete new handle after the wear of extended use.



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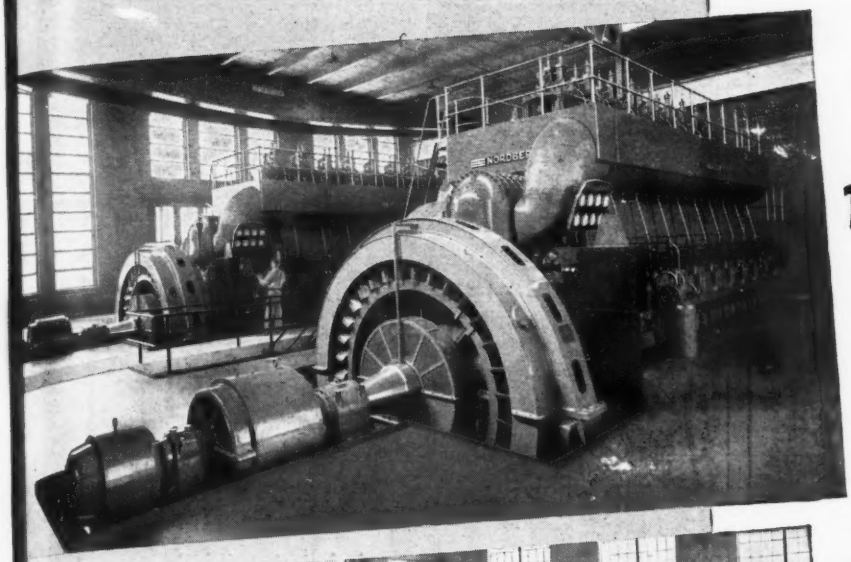

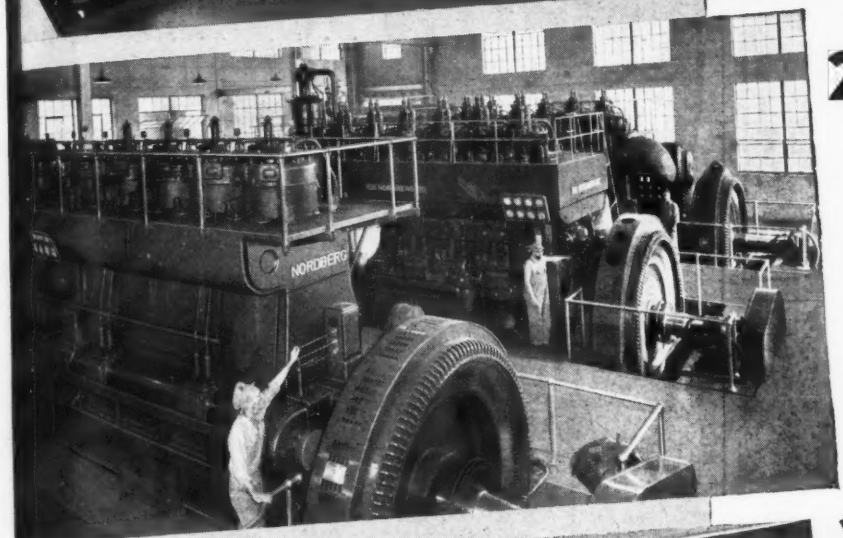

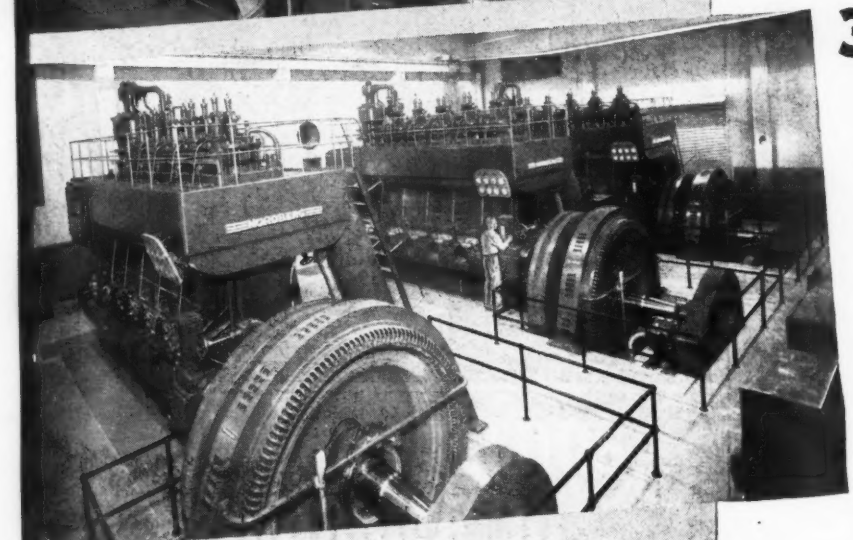

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. . . . such as this Iowa Electric Light & Power Co. installation at Marshalltown, Iowa. In addition to the two 3600 B.H.P. Nordberg Diesel Engines shown, there is a third Nordberg engine of 7100 B.H.P. installed in this same plant.

2 For MUNICIPAL PLANTS

. . . such as this typical installation for the City of Greenville, Texas, showing three of the five big Nordberg Diesel Engines generating dependable, low-cost power for this municipality. From an initial installation of two units of 2450 horsepower made in 1933, the plant now has a total of 9650 horsepower in Nordberg Diesels.

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. . . such as this modern, air-conditioned installation at the Universal Atlas Cement Co. plant, Atco, Texas. The three 2000 horsepower gas burning Nordberg Diesels in this plant are proving that they produce power at lower cost than is possible with any other type of power unit.

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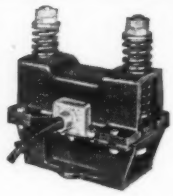

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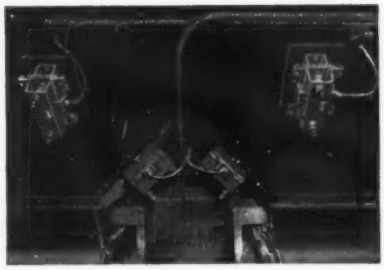

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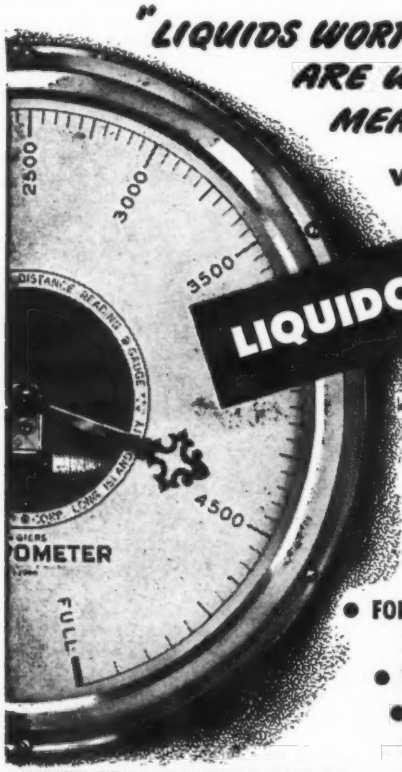

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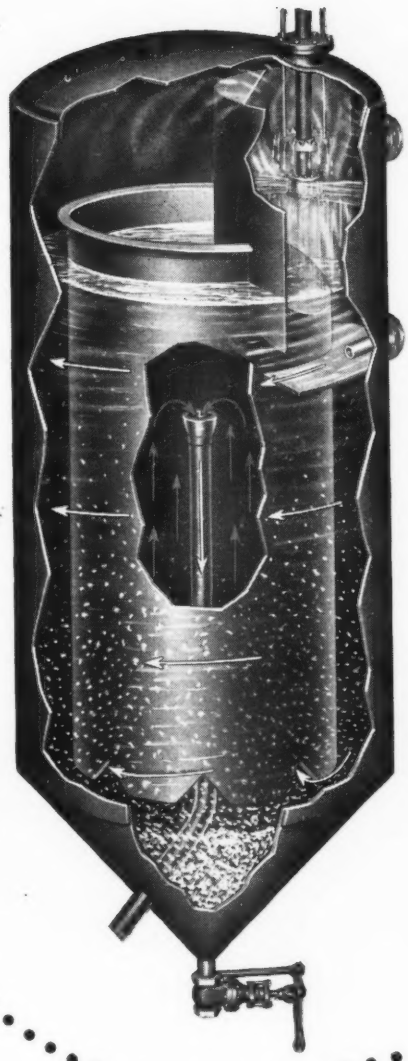

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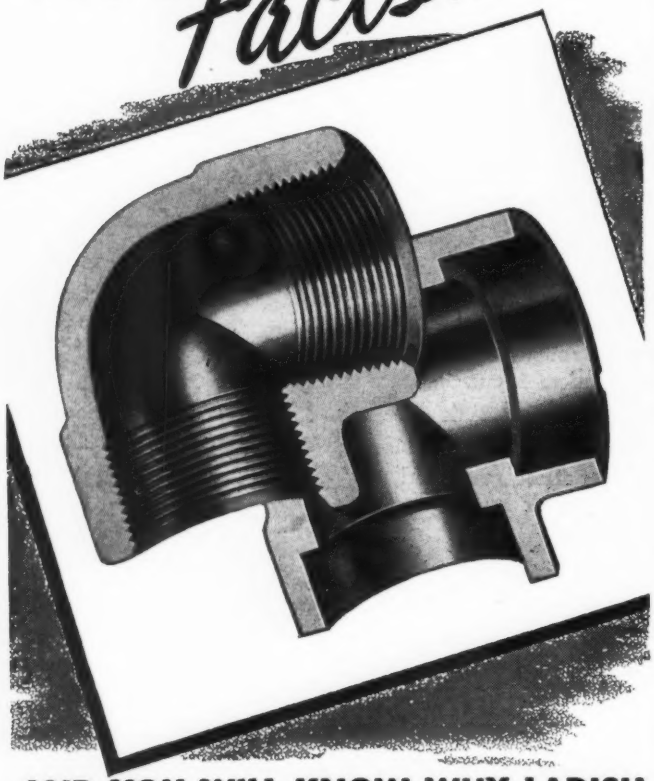

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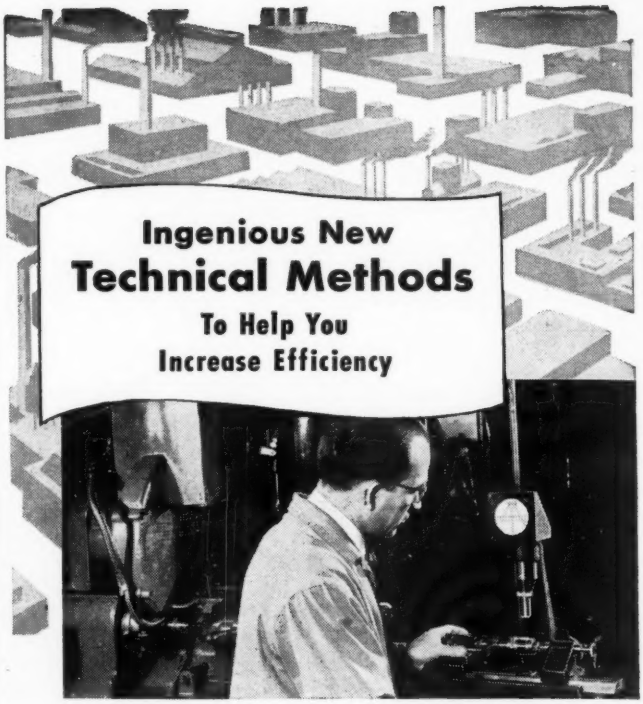
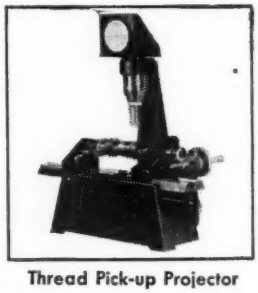


Ingenious New Technical Methods To Help You Increase Efficiency

Light Projector Increases Thread Grinding Production

Production of thread grinding machines can now be increased through the use of a light projecting device called the Thread Pick-up Projector. The thread profile appears in a viewing screen, magnified 20 times, thereby permitting accurate visual adjustments.



Thread Pick-up Projector

In operation the Thread Pick-up Projector is placed alongside the thread grinding machine. A Dalzen Thread Grinder, Model No. 1, is shown above. While the machine is grinding the thread, the operator, using the Light Pick-up Projector, adjusts a "dog" on the next piece to be ground. When the "dog" and piece are then placed in the thread grinder the thread profile is automatically in location, ready for grinding immediately.

Even the most inexperienced personnel can "pick up the thread" using this instrument after only a few minutes demonstration. Grinding is also done more accurately and the viewer permits measurements of reliefs, notches, etc. to .0005 inch.

Efficiency of production can also be increased through the use of chewing gum. The act of chewing helps relieve nervous tension and seems to make the work go easier and faster. For these reasons, Wrigley's Spearmint Chewing Gum is being made available more and more by plant owners everywhere.

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AC-77

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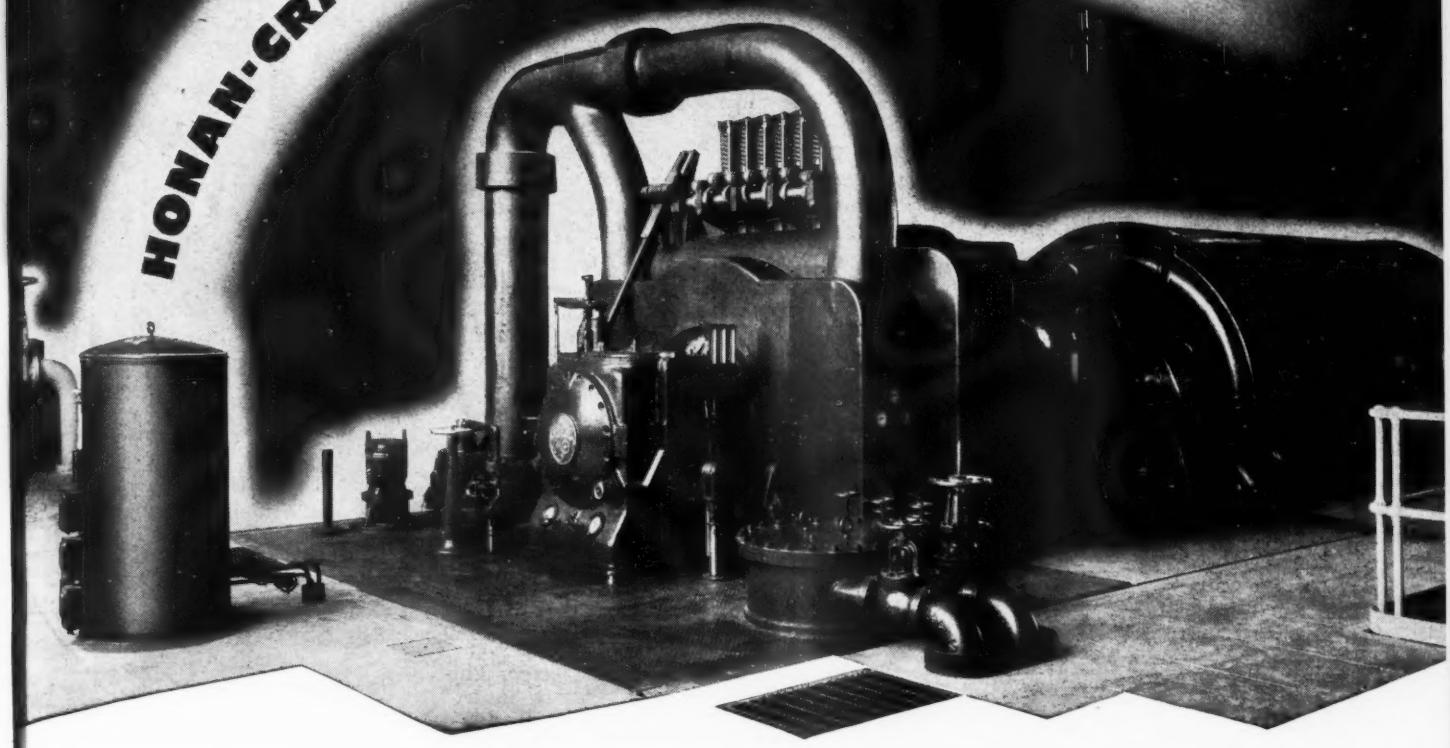

* The photo above shows a Model 30400 Honan-Crane Lube Oil Purifier direct-connected to a 25,000 KW General Electric Steam Turbine that furnishes power for the Lake Charles plant of the Cities Service Refining Corp.

. . . for many of the major oil companies*

There is significance in the widespread usage of Honan-Crane Oil Purifiers by petroleum refining companies—for turbine lubricating oils—for diesel lube and fuel oils—or for insulating oils.

No other industry has greater knowledge of the relation of *clean oil* to equipment maintenance. No other industry has more complete facilities for checking the actual value of oil purification—and the comparative performances of purifier and filter types.

And under these conditions, Honan-Crane Purifiers have been chosen as operating equipment by many of the major oil companies.

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* Shown above is a Honan-Crane equipped turbine installation. Other major oil companies using Honan-Crane Purifiers for turbines, diesel, gas and gasoline engines or other equipment are:

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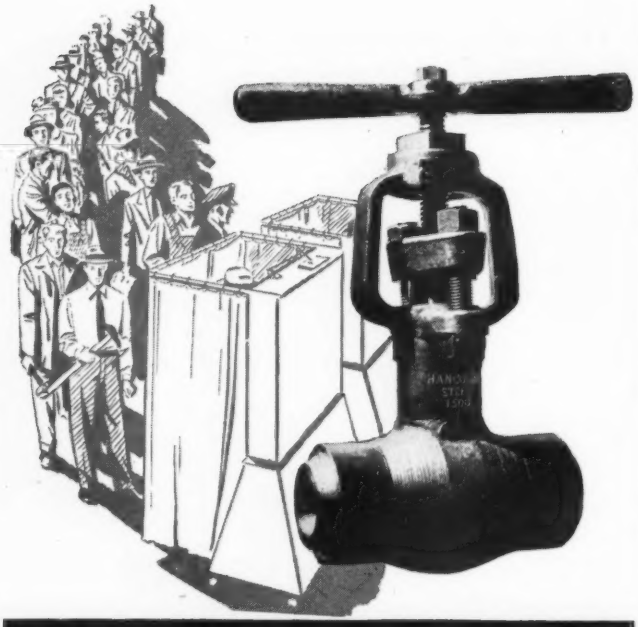

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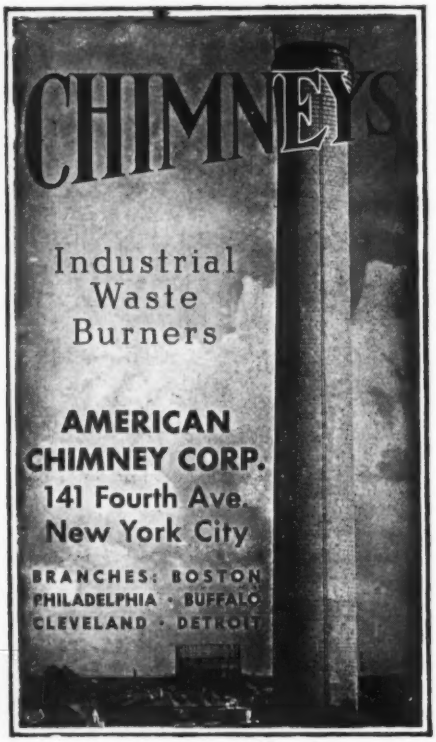

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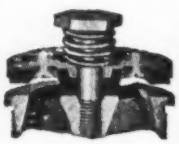

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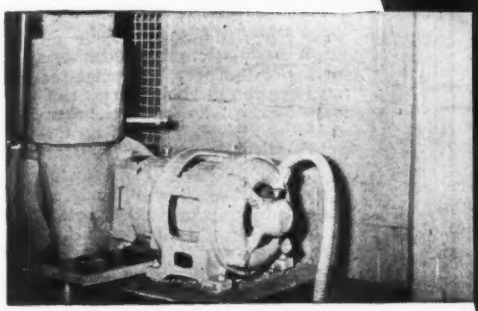

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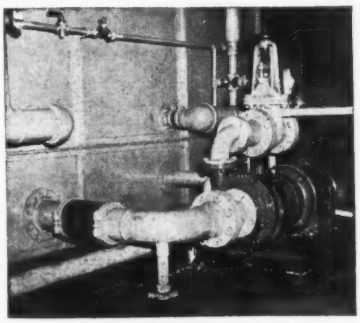

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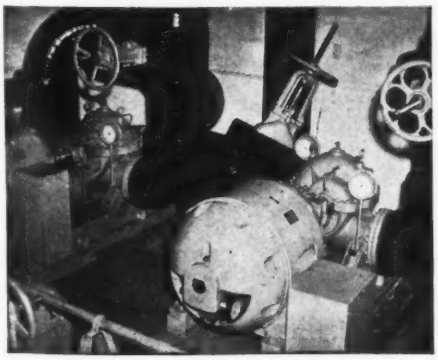

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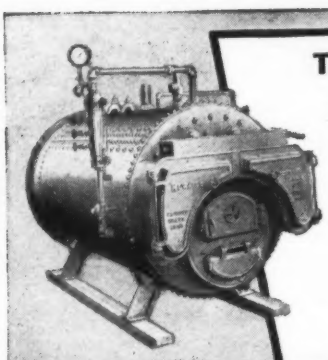

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For 6" Scale with pipe diameter markings—WRITE Dept. 99-A11

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Division of American Radiator & Standard Sanitary Corporation

Phil Swain invites you

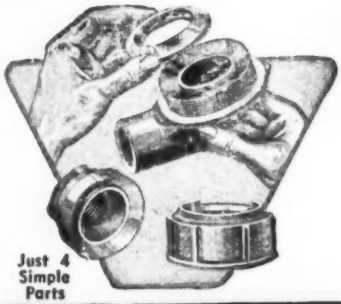
to visit the POWER booth (No. 42)

at the New York Power Show

•

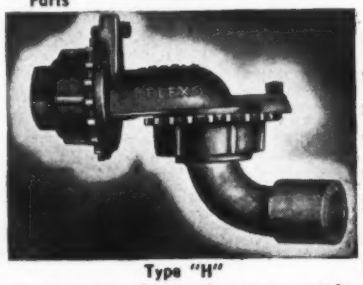
GRAND CENTRAL PALACE, NEW YORK

NOVEMBER 29 - DECEMBER 4



Just 4 Simple Parts

FLEXIBILITY *and* SAFETY with FLEXO JOINTS



Type "H"

Flexo Joints combine the flexibility of hose with the strength of pipe for conveying air, liquids, gases or vapors — wherever a swing joint is needed. Flexo Joints handle pressures and temperatures up to superheated steam with unrestricted flow. Made in four styles—each assembled from four interchangeable parts—each style for standard pipe sizes from ¼" to 3". Swivel movement 360°. Flexo Joints are designed for long wear—no springs—no small parts—maintenance cost is negligible.

Write for full details

FLEXO SUPPLY CO., Inc.

4655 Page Blvd. St. Louis 13, Mo.

In Canada: S. A. Armstrong, Ltd., 115 Dupont Street, Toronto 5, Ontario

Give these eye-opening facts on power systems to the men you depend on for savings

Up-to-the-minute 'Pack of Facts' points way to many plant economies

Are all the men in your plant responsible for savings fully aware of the difference that modern *plant power distribution* can make? Do they know how it affects plant layout...productivity... costs? Get the latest facts to them *now!*

IT'S EASY—General Electric, as a service to industry, has prepared the facts for you in visual terms that are easy-to-take...linger in the memory.

Here's what the power distribution program offers:

1. A fact-packed manual providing up-to-the-minute data on plant power distribution. Objective, *without sales bias,* it helps solve your power problems.

2. A slidefilm with sound that tells what load-center distribution is, and what it does. It aids the men who run your plant make money-saving decisions.

3. Fully illustrated highlights booklets, for individual study and review.

Convince yourself first—

We'd like you to examine the *Load Center Power Distribution Manual* without charge or obligation. Just use the coupon below.

Showings Cost You Nothing—With your manual, we'll tell you how to arrange for a FREE slidefilm showing.

Put these facts into the works—and watch them work for you.

FREE TO BUSINESS MANAGEMENT

Attach to your business letterhead

General Electric Co.
Section L684-4
Schenectady 5, N. Y.

Please send me a sample copy of the G-E *Load Center Power Distribution Manual* without cost or obligation, with details on how I can arrange a FREE SHOWING of the film. (Extra copies at regular manual price—$1.00.)

Name_____ Title_____

Company_____

Street_____

City_____

GENERAL ELECTRIC

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

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BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 1 line additional in undisplayed ads.

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NEW ADVERTISEMENTS received by November 5th will appear in the December issue, subject to limitation of space available.

MECHANICAL ENGINEERS
WITH 5 TO 15 YEARS EXPERIENCE
In Steam or Gas Plant Design
Write To
MECHANICAL ENGINEER
Pennsylvania Power & Light Company
Allentown, Pa.

POWER SUPERINTENDENT

Large steel plant Pittsburgh District wants power superintendent with qualifications to supervise boiler houses, water pumping, service water lines, hydraulic systems and steam engines driving primary rolling mills. State age and salary expected.

P-6665, Power
520 North Michigan Ave., Chicago 11, Ill.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

GRADUATE MECHANICAL Engineer, age 35-45, experienced in operation of modern oil burning steam electric power plant, including boilers and automatic combustion control. Will be responsible for operation and maintenance of boilers, turbines and all plant auxiliaries, and will have supervision of all labor so engaged. Must be capable of training men in power plant laboratory procedure. A knowledge of Spanish is desirable. Location: La Guaira, Venezuela. Salary open. Position permanent. Write giving full information as to age, education and experience. All replies confidential. C. A. La Electricidad de Caracas, Caracas, Venezuela.

STRESS ANALYSTS: Graduate in mechanical engineering or physics with five to ten years experience in theoretical or experimental stress analysis, preferrably on pressure vessels and heat exchange equipment. Knowledge of thermal stresses desirable. Excellent opportunity for qualified man in new Research and Development Department Laboratory. Write, giving resume of education and experience. The Babcock & Wilcox Company, Research & Development Dept., Alliance, Ohio.

CHIEF ENGINEER—Power Station—To take charge of 100,000 kw 1250 lb. steam turbine station now being constructed in Middle west area—should have experience with operation and maintenance 1200 lb. high temperature power station equipment, also experience successfully directing station operating organization. References required. P-6486, Power.

ASSISTANT SUPERVISOR—Power Station—Should be at least 30 years old and have technical education — also experience with operation and maintenance high-pressure, high-temperature power station equipment. Location Central Illinois. P-6487, Power.

RESEARCH DESIGNER: For the design of experimental apparatus. Each apparatus is designed individually to provide the conditions desired for the specific problem. These problems deal with applied research on heat transfer; metals under simulated service conditions; flow of water, steam and air, experimental stress analysis. Degree in engineering or physics with about five years experience in research or development is desirable. The Babcock & Wilcox Co., Research & Development Department, Alliance, Ohio.

WANTED: ENGINEER for design and installation of steam and electrical equipment in new plant of expanding industry. After construction, man selected will have possible opportunity as plant engineer. Complete information required in first letter. All details confidential. P-6784, Power.

WANTED

ASSISTANT TO PLANT MANAGER

To take complete charge of Fox River Valley (Wisconsin) paper mill power plant, supervising the operation and maintenance of high pressure boilers, turbines, and auxiliary equipment. Man with both technical and practical background preferred. Excellent opportunity to use initiative and supervisory ability. Give complete personal and business history in letter of application. All replies held confidential.

P-6539, Power
520 North Michigan Ave., Chicago 11, Ill.

POSITION VACANT

RESEARCH ENGINEERS: With degree in Mechanical Engineering or Physics and five to ten years experience in research or development work. For applied research on the flow of water, steam and air; metals under simulated service conditions; heat transfer; experimental stress analysis; all as applied to steam boilers and related equipment. Unusual opportunity for men in new research and development laboratory. The Babcock & Wilcox Co., Research & Development Department, Alliance, Ohio.

SELLING OPPORTUNITY OFFERED

WANTED SALESMAN or Distributor, knowledge of combustion engineering, with a large following amongst the heavy coal consumer to distribute a fuel economizer already in use in power stations and big industries. Several territories open. Commission. SW-6826, Power.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (38 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL, $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

DIESEL, ELECTRIC and Hydro or combination. Operation or maintenance. Available due to plant obsolescence and abandonment. Desires place south or southwest with reputable concern with opportunity to prove self with view towards stable future. No floater, no boomer, no boozer, non G.I. Health good. Age 40. Married with family. A.F. &A.M. and I.O.O.F. affiliation. Familiar with all phases electric generation, transmission and distribution. Resume of past experience furnished on request. PW-6333, Power.

YOUNG SALES Engineer, experienced in sales, service and design of internal combustion engines and steam turbine equipment, desires exceptional sales, purchasing or administrative opportunity. PW-6808, Power.

CONSTRUCTION SUPERINTENDENTS

Large engineering organization desires construction engineers. Must have considerable recent experience in steam-electric power plant construction, and be thoroughly qualified to direct field layout work, preparation of construction reports and specifications for subcontracts. Submit complete experience record.

P-6062, Power
330 West 42nd Street, New York 18, N. Y.

REPRESENTATIVES WANTED
FOR
COMPLETE LINE
OF
SHELL AND TUBE HEAT EXCHANGERS

- CHEMICAL
- INDUSTRIAL
- DOMESTIC

RW-5737, POWER
330 W. 42nd St., New York 18, N. Y.

WANTED MANUFACTURER'S REPRESENTATIVE
to contact coal-burning industrial institutions to distribute Today's Coal Bill Reducer (for high pressure boilers) which pays for itself quickly. Sales and combustion engineering experience desirable.
Address — P. O. Box 1367 — Chicago, Ill.

POSITION WANTED

YOUNG STEAM—Power Engineer desires permanent position with progressive firm now constructing or planning steam generating-steam power generating plant. Available on short notice to assist in erection and assembly of equipment, with view to assuming responsible position in plant upon its completion. Nine years practical experience in plant operation, three of these years supervisory capacity. Steam-combustion Engineering graduate I.C.S. Licensed operating engineer. Ohio, Maryland. 28 years of age, married, Navy veteran. PW-6604, Power.

SELLING OPPORTUNITIES OFFERED

SALES ENGINEER with headquarters in Kansas City desires to represent reputable companies as manufacturer's agent. Graduate engineer with 7 years production and design and 10 years sales experience. RA-6771, Power.

BOSTON SALES Engineer handling industrial mechanical stokers desires adjunct line of power plant equipment for New England; sound background in combustion and qualified to handle steam boilers or generators. SA-6644, Power.

SEARCHLIGHT SECTION

ELECTRICAL CABLE

BOUGHT AND SOLD

- ★ For every industrial and power application
- ★ LARGE STOCKS ON HAND
- ★ RAPID DELIVERY
- ★ CUT TO LENGTH
- ★ Send us your inquiries

UNIVERSAL Wire & Cable Co.
2660 N. Claybourn Ave. Chicago 14, Ill.

BOILERS

2 New 30 HP 150# Gas Fired Sellers Boilers. ASME construction—test run only. Pumping systems and automatic controls included.

WHEATLAND TUBE COMPANY
Wheatland, Pennsylvania

FOR SALE
CROCKER WHEELER MOTOR
300 HP, 230 Volts D.C., 500 RPM, Type CCM, Size 108DA, complete with Starting Control Panel.

ELECTRIC APPARATUS REPAIR CO.
1400 N. 6th St. Philadelphia 22, Pa.

When Writing Your Ad

Provide an indexing or subject word.

Write it as the first word of your ad.

If it is a Position Wanted or Position Vacant ad, make the first word the kind of position sought or offered.

This will assure proper classification in the column.

The right is reserved to reject, revise or properly classify all Want Advertisements.

Proper Classification increases the possibility of Prompt Returns

FOR SALE
Three Standard Iron Fireman Stokers
#3 Regular, Equipped with Westinghouse Class 1, 1½ H.P. 220-440 V. Motors, Model C-200 Controllers and ½ ton hoppers. Good Condition.

Contact C. F. Murray or G. G. Hengst
at FAIRCHILD AIRCRAFT DIVISION
Hagerstown, Maryland, Tel. 3600, Ext. 256 or 562

Complete dead front slate switch-board
3300 KW, 2300 volt. 14 street lighting, distribution and generating panels.

For information write

BOROUGH OF GROVE CITY,
Grove City, Pennsylvania

WANTED

WANTED

BOILERS

From 100 to 2000 HP

TURBO-GENERATORS

From 1000 to 5000 KW

COMPLETE BOILER PLANTS

Best cash prices paid. We have large domestic and foreign outlets. Send us full particulars.

J. PARKER THOMPSON CO., INC.
507 5th Ave., N. Y. C. MU. 7-6547-8-9

Air Compressors Wanted
Horizontal Water Cooled—Any size
also 2 Stage portable units

L. W. BAUER
North Bergen, N. J.

WANTED

2 used 4 cylinder 90 H.P.—10 x 11—300 R.P.M. Bruce MacBeth Engines.

W-5825, Power
330 West 42nd St., New York 18, N. Y.

WANTED
TURBO-GENERATOR
750 to 1000 K.W. Non-Condensing Unit 5# G.B.P. Direct connected to 240/3/60 Generator. Turbine good for 250#I.S.P. 475°F.T.T.

ROBERTSON PAPER BOX CO., INC.
MONTVILLE, CONN.

WANTED

Large Steam Engine, Turbine and Diesel Generating Sets; Motors, Motor-Generators, Rotaries, Large Power Transformers, Air Compressors, Pumps, High Pressure Boilers, etc.

H. W. WISWELL
4207 Russell Blvd. St. Louis 10, Mo.

—TRANSFORMERS—

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
MARIEMONT Since 1912 CINCINNATI 27, OHIO

WANTED

One 300 or 350 H.P., Slip Ring Motor, 440 Volts—690 R.P.M., Preferably with controls and grids. Recent Design.

AUTOMATIC GRAVEL PRODUCTS CO.
P. O. Box 869 Davenport, Iowa

Watch—
the *Searchlight Section*
for
Equipment Opportunities

THIS JLHCO

K on the equipment you buy means

used equipment-rebuilt and tested by our electrical engineers — to N. I. S. A. standards

TRANSFORMERS

3—1000 KVA, G.E., 4150 v. Primary 230/460 Secondary.
3— 300 KVA, Pitts., 2300 v. Pri., 115/230 v. Sec.
3— 300 KVA, G.E., type H, 2300 v. Pri., 115/230 v. Sec.
300 KVA, Pitts, 7800-440 v.
225 KVA, Whse., 2 phase, 2300 to 3 ph., 4150 autp.
200 KVA, Pitts., 4000 v.—110/220.
1— 150 KVA, G.E., KS 2300 v. Pri., 115/230 v. Sec.
100 KVA, Pitts., 1375/2750 v.—110/220.
3— 100 KVA, Wagners, 240/120 v.—120 v.
2— 100 KVA, Newark, 440 v., 2 phase to 220 v., 3 ph.
3— 100 KVA, Whse., 13,800 v. to 250 v.
3— 75 KVA, G.E., 2400 v.—120/240.
6— 50 KVA., Whse., 2400 v.—120/240.
6— 50 KVA, Whse., 13,800 v. to 125 v. or 250 v.
6— 50 KVA, Whse., 6900 v. to 125 v. or 250 v.

A. C. GENERATORS

2500 KVA, Whse., Syn. Cond., 720 RPM, 2400 v.
500 KW, .8 P.F., 3600 RPM, ATB, 600 v.
320 KW, Allis, 450 RPM, 480 v.
240 KW, G.E., ATB, 600 RPM, 600 v.
200 KVA, Allis, 3600 RPM, 240 v.
200 KVA, Whse., 600 RPM, 240 v.
180 KW, Whse., 514 RPM, 550 v.
165 KW, El. Mach., 514 RPM, 240 v.
100 KW, G.E., ATB, 600 RPM, 240 v.
75 KW, Whse., 900 RPM, 220 v.
62½ KW, Allis, 3600 RPM, 220 v.
7— 50 KVA, Whse., 900 RPM, 220 v.
3— 35 KVA, Columbia, 1200 RPM, 240 v.
1— 31.3 KVA, America, 1200 RPM, 120/208.
15 KW, Star, 1800 RPM, 220/440.
12.5 KVA, Whse., 1200 RPM, 240 v.

TURBINE BLOWERS

1—Spencer Turbine Blower, 1000 cubic feet, 30 oz. pressure with a 15 H.P., 3600 RPM, General Electric Type FT, 200 volt motor.

1—Bellmore, 550 cubic feet, 7 inch vacuum, with a 20 H.P. 3600 RPM, General Electric, Type K, 220 volt 3 phase motor.

MOTORS, 3 Phase, 60 Cycle

SQUIRREL CAGE

750 H.P., General Electric, 750 RPM, 6600 v., 25 cycle.
450 H.P., Ridgeway, 900 RPM, 2200 volts.
125 H.P., G.E., KF, 1750 RPM, 2200 volts.
125 H.P., U.S., 1200 RPM, Vert. 220 volts.
150 H.P., G.E., KT, 1200 RPM, Vert., 220 volts.
75 H.P., West., CS, 1750 RPM, 440 volts.
60 H.P., Whse., 900 RPM, Vert., 2200 volts.
60 H.P., Whse., 900 RPM., 440 volts.
2— 40 H.P., G.E., 900 RPM., 220 volts.
35 H.P., Whse., 1200 RPM, CS, 2200 volts.
35 G.E., 600 RPM, 550 volts.
25 H.P., U.S., 1800/1200/900/600, 440 volts.
2— 10 H.P., Whse., Gear 440 RPM, 440 volt.

MOTORS, 3 Phase, 60 Cycle

SLIP RING

450 H.P., G.E., 425 RPM, ITC, 440 volts, 25 cycle.
200 H.P., G.E., MT, 440 volt, BB, 720 RPM.
100 H.P., G.E., IM, 440 volt, 25 cycle, 720 RPM.
75 H.P., Whse., CW, 720 RPM, 440 volt.
75 H.P., G.E., MT, 1200 RPM, Vert.
50 H.P., G.E., MT, 600 RPM, 220 volt.
2— 50 H.P., Whse., CW, 900 RPM, 220 volts.
40 H.P., Cont., 1200 RPM, JA85, 220 volt.
40 H.P., G.E., 1200 RPM, MT, 220 volt.
40 H.P., G.E., 900 RPM., 220 volt, ITC.
40 H.P., G.E., 900 RPM, MT, 900 RPM, 220 volt.
40 H.P., G.E., 900 RPM, 2200 volt.

AIR COMPRESSORS

312 CFM, 100 lb. Ingersoll Rand, model 75, with motor.

LARGE STOCK OF D.C. MOTORS AND GENERATORS

SYNCHRONOUS MOTORS

4—200/100 H.P., Whse., 720/360 RPM, 4150 v.
200 H.P., Whse., 600 RPM, 240 v.
1—150 H.P., G.E., 1800 RPM, 220 v., TS.
3—150 H.P., G.E., type TS, 450 RPM, 440 v.
75 H.P., G.E., 1200 RPM, 440 v.
70 H.P., Elect. Mach., 180 RPM, 2200 v.
40 H.P., Whse., 1800 RPM, 220 v.
35 H.P., G.E., 1200 RPM, 2200 v.
20 H.P., Whse., 1800 RPM, 220 v.

MOTOR GEN. SETS

1—500 KW, G.E., 250 v., 900 RPM, 2300 v. Syn.
1—500 KW, G.E., 575 v., 900 RPM, 2300 v. Syn.
125 KW, CW, 125 v., 1200 RPM, 2300 v. sq. cage.
100 KW, El. Mach., 125 v., 1200 RPM, 4150 v. Syn.
2— 75 KW, G.E., 125 v., 1200 RPM, 220/440 v.
6— 75 KW, G.E., 60 v., 1200 RPM, 220/440 v.
50 KW, Ridgeway, 550 v., 1200 RPM, 220 v.
25 KW, G.E., ATI, 1800 RPM, 40 H.P., 1800 RPM, 230 v.

PLATING M. G. SETS

250 amp., G.E., 5/6 v.
500 amp., Hansen Van Winkle, 24 volt, 220/440 v.
2500 amp., Chandeysson, 6/12 v., 400 RPM, Syn., 440 v.
3000 amp., Chandeysson, 6/12, 400 RPM, Syn., 440 v.

ENGINE GEN. SETS

150 KVA, G.E., Ames Uniflow, 220 v., 3 ph., non-cond.
2— 5 KW, Gasoline, Hobart, 1800 RPM, 120 v., 1 ph. cont. engines.
1—200/275 H.P. Gasoline Engine, Van Blerck, 8 cylinder, 1500/900 RPM.

TURBO GEN. SETS

625 KVA, Westinghouse, 2400 v., 3 phase, non-con.
300 KW, G.E., ATB, 240 v., 3 ph., cond.
60 KW, Whse., 120 v., D.C., cond.
30 KW, Allis, 120 v., D.C., Terry non-cond.

STEAM TURBINES

500 H.P., G.E., 3 stage, 165#, 3240 RPM.
800 H.P., Terry Tandem type, 720 RPM, red. gear.

JLHCO

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

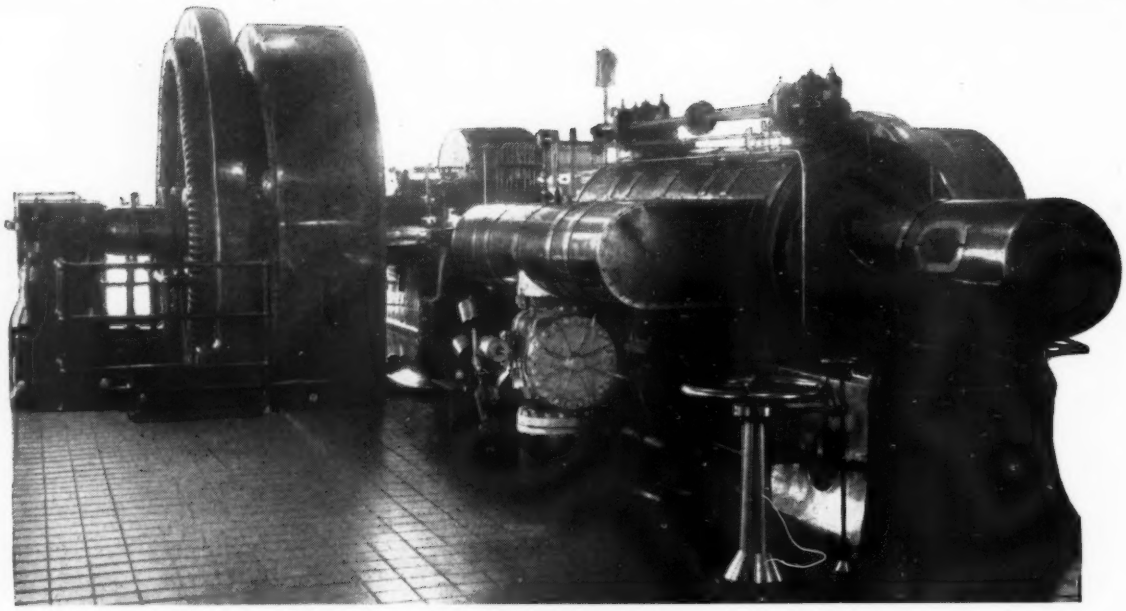
J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

POWER PLANT MACHINERY



Actual Photograph

500 KVA SKINNER UNIVERSAL UNIFLOW ENGINE GENERATOR UNIT

400 KW 80% P.F. 500 KVA General Electric alternating current generator, 3 phase 60 cycle 460/230 volts, 150 RPM, direct connected to Skinner Universal uniflow engine, 160# steam pressure, 0-5# back pressure. Complete with switchboard and auxiliaries. Excellent condition, can be shown in operation.

CONDENSING TURBO UNITS

3 phase 60 cycle

6000 KVA Westg., 2300 volts, 250# steam
3125 KVA G.E., 2300 volts, 175/400# steam
1563 KVA G.E., 2300 volts, 225# steam
1250 KVA Westg., 2400 volts, 450# steam
1250 KVA (2) G.E., 2400 volts, 200/400# steam
750 KVA (2) Kerr, 480 volts, 150# steam, 5# extraction
625 KVA (2) G.E., 2300 volts, 160# steam
375 KVA (2) G.E., 450 volts, 400# steam

NONCONDENSING TURBO UNITS

3 phase 60 cycle

5000 KVA G.E., 13800 volts, 600# steam, 135# extraction, 25# exhaust
1250 KVA Westg., 2300 volts, 300# steam, 10# exhaust
937 KVA Allis, 4000 volts, 250# steam, 15# exhaust
625 KVA G. E., 2300 volts, 160# steam, 5# exhaust
250 KVA G.E., 480 volts, 250# steam, 50# exhaust

UNIFLOW UNITS

3 phase 60 cycle

1125 KVA Nordberg, 480 volts, 160# steam, 5# exhaust
750 KVA Skinner, 460 volts, 150# steam, 5# exhaust
625 KVA Nordberg, 2300 volts, 160# steam, 5# exhaust
500 KVA Skinner, 450 volts, 160# steam, 5# exhaust
312 KVA (2) Skinner, 450 volts, 150# steam, 5# exhaust
250 KVA (2) Skinner, 450 volts, 160# steam, 5# exhaust
187½ KVA Skinner, 450 volts, 150# steam, 5# exhaust

SYNCHRONOUS MOTORS

6—3500 HP G. E. totally enclosed synchronous motors, 3 phase, 60 cycle, 1700 volts, 257 RPM. Equipped with surface air coolers and couplings. New 1943. These motors can be reconnected for 440 volts or rewound for 2300 or 4000 volts.

DIESEL UNITS

3 phase 60 cycle

1100 KVA (2) Nordberg, 2400 volts
1000 KVA Busch-Sulzer, 2400 volts
900 KVA Fairbanks-Morse, 2300 volts
500 KVA Fairbanks-Morse, 2400 volts
187 KVA (3) Buckeye, 240 volts
94 KVA (3) Caterpillar, 220 volts

MOTOR GENERATOR SET

60 KW General Electric interpole direct current generator 110 volts, direct connected to 85 HP General Electric induction motor, 3 phase 60 cycle, 440 volts, 1765 RPM. New 1943.

PACKAGE TYPE BOILERS

4—60,000 steam per hour Foster-Wheeler steel-encased boilers, two drum, bent tube, 435# pressure, 750 deg. total temperature, with water walls, superheaters, economizers, and Todd oil burners. New 1943.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 CLEVELAND 14, OHIO

BELYEA SAYS: "BUY FROM THE OWNER AND GET A BETTER BUY"

RE-NU BILT BELYEA MOTORS

RE-NU-BILT EQUIPMENT

Rebuilt in accordance with N. I. S. A. STANDARDS

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	D.C. Speed	Volts	A.C. Volts
1	1800	G.E.	600	125/250	4000
1	1500	G.E.	600	600	2300/4150
1	1500	G.E.	360	275	2200/4400
1	1000	West.	514	250	4150
1	1000	Al. Ch.	720	450	2300
1	1000	Whse.	514	600	4150
2	500	G.E.	720	600	2300/4150
1	500	G.E.	720	600	4400
1	500	G.E.	720	125	2300/4000
2	400	G.E.	720	250	440/2300
1	350	G.E.	900	125	50
1	300	G.E.	720	550	2300/4000
1	250	G.E.	720	275	2300/4000
2	250	G.E.	1200	250	440
1	175	Cr. Wh.	1200	250	440
1	150	Cr. Wh.	1200	250	440
1	100	G.E.	1170	125	220
1	90	G.E.	1800	60	220/440
1	75	Cr. Wh.	1160	250	220/440
1	75	G.E.	1180	125	2300/4000
1	60	Cr. Wh.	1750	250	220/440
1	60	Whse.	1150	60	220/440
1	50	G.E.	1145	125	220
2	50	G.E.	1200	250	2200

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4000	G.E.	TSC	2400/4800	900
1	3000	Whse.		4800	720
1	3000	G.E.	ATI	4800	720

ROTARY CONVERTERS

60 Cycle

KW	Make	Speed	D.C. Volts	A.C. Volts
1—2000	G.E.	514	600	2300
1—2000	G.E.	450	600	2300
1—1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 500	Whse.	900	250	2300

FREQUENCY CHANGER SETS

1—1000 KW—GE—2 unit—3 Brg. Consisting of—1400 HP—4400 V, 3 ph. 25 cy. Motor and 1000 KW—2300 V. 2 ph. 58.3 cycle gen. with exciter (Gen. can be reconnected for 800 KW 3 ph.)

1—320 KW—GE—2 Unit—3 Brg. consisting of 600 HP—440 V., 3 ph. 60 cy., 8 pf. Syn. Motor and 400 KVA, .8 pf, type AT—3 ph, 120 cy, 720 volt AC generator with direct connected exciter.

D. C. MOTORS

HP	Make	Type	Volts	Speed
6—1500	Whse.		525	600
1—1200	Whse.		600	425
1—800/1000	Whse.		450	600/720
1—700	G.E.	MCF	600	150/525
1—650	G.E.	MPC	250	115/145
1—300/400	G.E.	DYNA	250	1325/2500
1—335	Whse.	MQ	250	300/900
1—275	Whse.	QM-600-6	230	425/850
1—250	G.E.	MPC	230	400/500
1—230	Al. Ch.		230	700
1—222	Whse.	SK-153.5S	230	2975
1—80/180	G.E.	MPC	240	400/1000
1—150	G.E.	MPC	230	250/450
1—150	Cr. Wh.	CCM	230	300/1050
1—150	G.E.		600	250/750
10—150	Cr. Wh.	83H	230	890
1—150	Cr. Wh.	CMC-65H	230	1150
2—125	G.E.	CO-1832	230	625
1—125	El. Dy.	30S	230	750/1500
1—115	Cr. Wh.	JHL	230	1200
4—101	Whse.	SK	230	485/950
1—100	Rel.	1050T	230	400/1200
1—100	Whse.	SK-182	230	300/1200
1—50/100	G.E.	CD-175	230	365/730
1—80	El. Dy.	30S	230	500/1500
1—80	Whse.	SK-180	230	450/1200
2—75	El. Dy.	25-SL	230	750/1750
3—60/75	Whse.	SK-200	115	300/700
8—75	Cr. Wh.	53-H	230	860
1—75	Cr. Wh.	CMC	230	1150/1760
1—60	El. Dy.	25-S	230	525/1050
2—60	Whse.	Hoist.	230	415
1—60	Whse.	SK	230	500/1000
1—60	Whse.	SK-131	230	500/1500
1—60	El. Dy.	25S	230	750/1500
2—50	G.E.	RCP-31B	230	1700
1—50	G.E.	RC-34	230	1050
1—50	G.E.	RF-16	230	500/1500
1—50	Whse.	SK-131	230	500/1500
4—50	Whse.	Hoist	230	400
1—50	Whse.	SK-153	230	690/1035
1—50	G.E.	CD-123	230	675/1035
1—50	Whse.	SK-170	230	350/1050
1—50	Cr. Wh.	CMC-8014	230	380/750
2— 40	Rel.	365-T	230	400/500

These units are semi-enclosed, b. brg. motors and part of complete V-S Drive with 40 KW Ind. M.G. Set with 220/440 v. A. C. Motor; exciter and complete control equipment. M. G. and control in steel enclosure.

SPECIAL—MERCURY ARC RECTIFIERS

1—750 KW—GE—Type RHW—6 Anode 575 V., D.C. Form C with 2300 V., 60 cycle transformer and switching equipment.

Turbo Generators

See our advertisement on page 293

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
1—2100	G.E.	ATI	4600	510
2—2000	Whse.		2300	120
1—1000	Whse.		2300	1891/2
1— 900	Al. Ch.	(New)	2200	150
1— 600	Whse.	Syn.	440	360
1— 500	G.E.	ATI	480	900
2— 500	G.E.	TS	4150	600
1— 450	Whse.		2300	128.5
2— 450	Whse.		2300	1800
2— 400	G.E.	TS-9838	440	600
2— 350	G.E.	TS	2200	150
1— 325	Whse.		440	900
1— 320	G.E.	ATI	2300	600
1— 300	G.E.	ATI	440	720
1— 145	G.E.	ATI	550	720
1— 100	Whse.		550	600

SLIP RING

1—1000	Whse.	CW	2300	700
1— 900	G.E.	IM	2300	880
2— 700	Whse.	CW	2200	900
1— 500	G.E.	IP	550	505
1— 400	G.E.	IM	2200	252
3— 350	Whse.	CW	2200	900
1— 350	G.E.	MT-442Y	2200/4000	253
1— 300	Whse.	CW	440	1750
1— 300	Al. Ch.	3 Brg.	2300	505
1— 250	G.E.	MT-563Y	550	900
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-559S	2200	1800
1— 135	G.E.	IM	2300	700
2— 100	G.E.	IM-16	2200	435
1— 75	Whse.	CW-761	2300	1750
1— 75	F.M.	Bv-H16B	2300	1750
3— 50	Whse.	CI-638A	220	870
2— 50	Whse.	CIW-504	440	870
1— 50	Rel.	1XM	2300	880
1— 50	G.E.	MT-352	550	600

SQUIRREL CAGE

1— 250	G.E.	IK	440	600
1— 250	G.E.	KT-559	440	1800
1— 200	G.E.	IK	550	865
1— 125	Whse.	M8	440	485
1— 125	(New)	G.E.	KF-TEFC	440	1190
1— 100	G.E.	IK-Vert.	2300	450
1— 100	G.E.	KT-543	220/440	1750
1— 75	G.E.	K	2200	1200
2— 60	G.E.	K-505	440	1170
1—60/20	Whse.	CS	220	900/450
1— 50	G.E.	KF-405S	220/440	3550
2— 50	Whse.	CS	220	870
1— 50	G.E.	KT-327	2200	1750

With men who know machinery **it's been BELYEA CO., INC.**

Main Office and Shop
43 HOWELL ST., JERSEY CITY 6, N. J.
Phone—Journal Square 2-3334
Also N. Y. City Line—Rector 2-7150

for 40 years

and still going strong

GLOW

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
350	514	440	GE-I
250	600	2300	Triumph
200	490	2200	GE
200	600	440	Westgh.-CS
125	340	220	A-C
100	1800	2300	Burke
100	1200	440	C-W
85	3600	2200	GE
75	900	2300	GE
75	720	2300	Wagner
75	360	220	GE-I
60	3600	2300	GE-KT
60	1800	440	Al. Ch.
60	1800	2300	GE-FTR
50	3600	440	R. & M.
50	1800	220	GE-KT
50	1200	220	GE-KT
50	900	220	GE
50	720	2300	Wtg.-CS
40	1200	220	GE-KT
40	900	2300	Wtg.-CS
40	720	440	GE-KT
35	900	220	GE-KT
35	600	220	FT. Wayne
30	1800	dual	Delco
30	1200	dual	Master
30	720	220	GE-HI
30	514	440	Stanley
25	3600	dual	L-A
25	1800	dual	GE
25	1200	220	Wesche
25	900	440	GE
25	900	220	GE-FTR
25	720	220	Wagner
25	600	440	GE-I
20	3600	dual	GE
20*	1800	220/440	Master
20*	1800	220/440	Wesche
20	1200	440	Al. Ch.
20	900	440	Wtg.-CCL
20	600	220	GE
15	3600	220	GE-KT
15	1800	220	W-E
15*	1800	220/440	Master
15	1200	220	Ridgeway

ENCLOSED SQUIRREL CAGE

HP	RPM	Volts	Make
125*	1200	440	GE-TE-FC-BB
60	900	440	GE-TE-FC-BB
40	1200	220	Westgh.
30	1800	dual	Delco
30	1200	440	Wagner
20	1200	440	Wagne.
20	900	440	GE-TE-FC-BB
15	1800	dual	Delco
15	1200	220/440	Delco-TEFC-BB
10	1200	440	GE-TE-FC-BB
7½	1800	dual	Wagner-TEFC-BB
7½	1800	dual	Master-TEFC-BB
7½	1200	dual	GE-HI Slip-TEFC-BB
7½	1200	dual	Delco
7½	1090	220/440	GE-KR, high slip
7½	900	dual	Delco-TEFC-BB
5	3600	dual	Delco-TE-FC-BB
5*	1800	dual	Master-TEI C-BB
5	1800	220	Wagner TE-BB
5*	1200	dual	GE-TEFC-BB
3	3600	440	Wtg.-TE-BB
3½	1800	dual	Delco-TEFC-BB

*New Motor

ENCLOSED SQUIRREL CAGE—Cont'd.

HP	RPM	Volts	Make
3	1200	dual	Rel-TEFC-BB
3	900	dual	Delco
2	1800	dual	Delco-TEFC-BB
2	1200	220	GE-TE-BB
2	900	220	Wagner-TE-BB
1½	900	dual	Delco-TEFC-BB
1½	1800	dual	L. Al.-TE-BB
1½	1200	dual	Ref-TE-BB
1	3600	220	Haskins-TEFC
1	1800	dual	Master-TEFC-BB
1*	1800	dual	Delco-TE-BB
1*	1200	dual	Rel-TE-BB
¾	3600	4400	Delco-TE
¾	1800	dual	Wesche-TE-BB
¾	3600	220	Ohio-TE-BB
¾	1800	440	Wtg.-TE-BB
¾	1800	440	Delco-TE-BB
¾	1800	dual	Delco-TE-BB
¾	1200	220	Cr. Wh.-TE
¾	900	dual	Delco
¾	3600	dual	Delco
¾	1800	dual	Delco

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg.
400	1200	2300	Al. Ch.
375	1800	2300	Al. Ch.
350	900	2300	Westg .
250	300	2300	Al. Ch.
235	1800	220	GE-I
60	1800	dual	Al. Ch.
60	900	2300	Burke
60	900	220	Wesche
50	900	2300	Ridgeway
50	900	440	Wagner
50	720	440	Al. Ch.
50	1800	220	GE-MT
40	1200	220	GF-MT-336
40	900	220	Wtg.-HF
40	720	2300	Wtg.-HF
40	720	220	Al. Ch.-ARY
40*	600	2300	Al. Ch. ARY
40	600	220	Al. Ch.-ARY
40	450	220	Triumph-C
35	1200	220	Westgh.
35	900	220	Al. Ch.
35	900	2300	Ridgeway
35	720	220	GE-I
30	1800	2300	Wtg.-CW
30	1800	220	GE
30	1200	440	Wagner
30	1200	2300	Lincoln
30	900	220	GE-MT
30	900	2300	Ridgeway
30	720	220	GE-I
30	600	220	F. Morse-BV
25	1200	2300	Al. Ch.-ANY
25	1200	220/440	Watson-KH
25	900	220	GE-MT
25	600	220	Watson

VERTICAL MOTORS

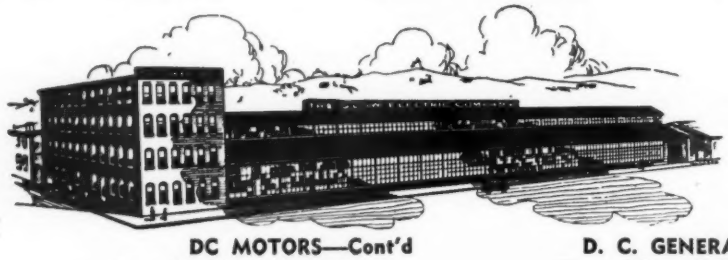
HP	RPM	Volts	Make
200	120	440	Al. Ch.-SR
150	1200	2200	GE-I
150	1200	440	GE-Cage

VERTICAL MOTORS—Cont'd.

HP	RPM	Volts	Make
125	1200	2300	Al. Ch.-Cage
100	1200	440	GE-Cage
75	1200	2200	GE-Cage
75	360	220	Ideal-Cage
60	1800	230 D.C.	GE
60*	1200	440	Al. Ch.-Cage
50	1200	2200	Wtg.-Cage
40	1800	220	GE-Cage
40	1700	230 D.C.	GE
40	1200	440	Wtg.-SR
40	1200	220	GE-Cage
40	1800	440	GE-Cage
35	1200	2300	Al. Ch.-Cage
35	450	440	GE-Cage
30	1200	dual	Wtg.-Cage
25*	1650	230 D.C.	GE
25	1200	2200	GE-Cage
25	850	230 D.C.	Wtg.
20*	1800	440	Al. Ch.
20*	1200	440	Al. Ch.-Cage
15*	1800	440	Al. Ch.-Cage
15	1750	110 D.C.	Wtg.
15	1150	230 D.C.	GE
15	600	440	Al.-Ch.
12½	900	220	L. Al.-Cage
10	3400	230 D.C.	Wtg.
7½	1800	500 D.C.	Peerless
7½	900	440	Burke
7½	700	230 D.C.	GE
6	850	110 D.C.	Rel.
5	1400	230 D.C.	R. & M.
5	600	440	GE-Cage
4	1650	110 D.C.	Watson
3	1700	230 D.C.	Watson
3	1200	dual	Wtg.-Cage

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
3000	720	4800	GE-ATI
1015	600	2200	Wtg.-25 cycle
700	500	11000	GE-25 cycle
600	750	440	GE-25 cycle
500	600	4160	GE
350	750	4000	GE-25 cycle
250	225	2200	GE-TS
220	600	2300	GE-ATI
250	225	2200	GE
250	225	440	GE
200	225	2200	Wtg.
160	600	440	GE-ATI
115	164	208	GE
60	360	2200	GE
50	1200	440	Wagner
50	360	440	GE
30	900	440	Wagner
30	600	550	GE
30	450	dua	Wtg.
30	360	550	GE
30	327	220	E-M
25	1800	220	Wagner
25	450	220	E-M
25	300	220	Idea!
20	900	220	Wtg.
20	600	220	E-M
15	1800	220	Wagner
10	1800	220	Wagner
10	1200	220	Wagner
7½	1200	410	Wagner



D. C. MOTORS
115 Volts

HP	RPM	Description
225	750	GE-MPC
60	1200	Star
35	975	Northern
35	610	GE
30	1800	F-M
30	200/600	Sprague
25	1150	Triumph
25	750	GE
20	700	Triumph
20	500/1500	GE-RF11
20	400/1200	GE-RLC fr. 202A
15	1200	J. & L.
15	1000	GE-CE
15	975	F-M
15	725	Westgh.-S fr. 6
10	700	J. & L.
10	650	J. & L. type CI
8	1500	Elect. Dynamic (series)
7½	3500	GE, type B
7½	1150	F-M, type CP
7½	975	Westgh.-S-3
7½	750	J. & L. type CI
7½	700	J. & L. type CI
7½	500/1500	Reliance-T-66T
7½	500	Westgh.-SK-BB
7½	170/220	Diehl-NG90
5	3600	Star-SF3-BB
5	1800	Wesche-BB
5	950	Swing-E-6

DC MOTORS—Cont'd

5	650/1950	Imperial-HVI
5	535/1070	C-W, type CMC
5	400/1600	Northern-S
5	260	Diehl-BB
2½	575	GE-RC
2½	300/1200	Reliance-34T
2*	3500	American, type I-BB
2	1200	Westgh-SK
2	1000	Triumph
2	900	Watson-AW4B
2	500/2000	GE-CD
1½*	1750	Marathon
1½	600/1800	Watson-BW
1½	500/1500	GE-RA
1	1725	B-B, type DM
1	1150	GE-RC
1	920	Peerless
1	700	F-M, type TR
1	780/1560	C-W, type CM
1	600	Northern

*New Motor

D. C. GENERATORS
125 Volts

KW	RPM	Description
500	750	GE-MCF
300	1500	GE-CC
100	1000	WE-DLC
100	900	C-W-CCD
80	500	J. & L.-G
80	400	J. & L.-G
65	1100	W-E, type ELC-7
60	1200	Star, type SQ single bearing
55	1000	GE-Type TD
35	1165	GE-DLC
31.25	1400	Westgh.-SK-single bearing

D. C. GENERATORS—Cont'd.

30	1200	Al. Ch., single bearing
25	1200	Westgh.-SK, single bearing
25	1100	GE-CI.
25	600	Westgh.-SK, frame 150
25	300	W-E, type B
15	3600	GE-BF
15	1100	Al. Ch
10*	1750	Westgh.-SK-43
9	1100	R. & M.
9	400	F-M
7½	3600	GE-BR
4	750	Westgh.-SK501.
2	1400	Westgh.
2	1200	Westgh.-SK

D. C. GENERATORS
230 Volts

KW	RPM	Description
400	1200	Westgh.
200	375	J. & L.-type K
175	450	Westgh.
125	1400	Westgh.-SK-1301.
80	1050	W-E
35	1800	GE-RC
30	300	Triumph
22½	765	Westgh.-SK
18	300	Burke
15	350	Westgh.-SK
15	250	GE-CD
5	850	Triumph
1½	900	J. & L.-AI-7

ELECTRIC CO

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC EQUIPMENT
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

927 HARRIET ST.
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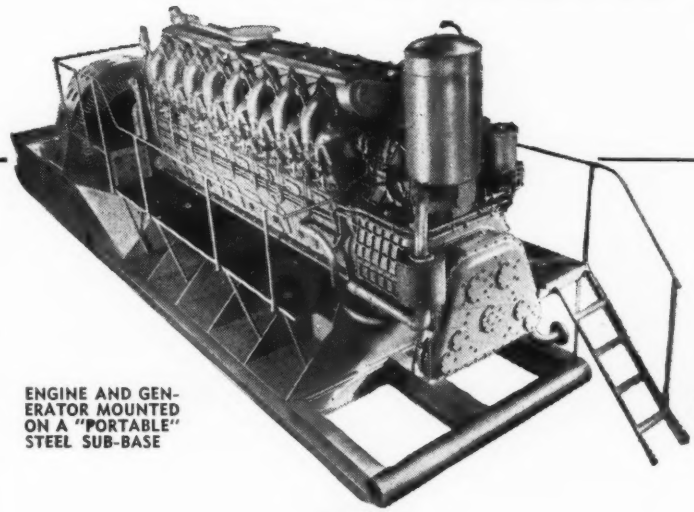
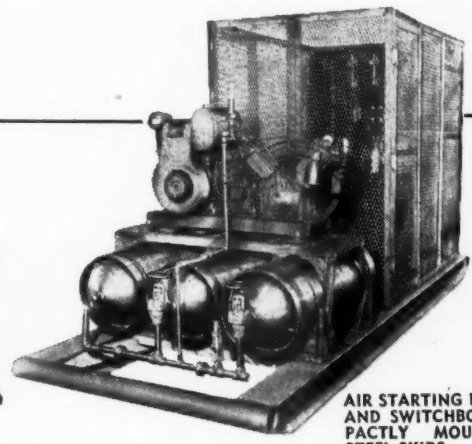
CINCINNATI 3, OHIO

PORTABLE DIESEL PLANTS

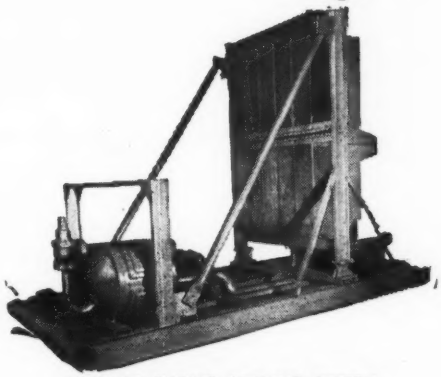
OFFERED FOR QUICK DELIVERY



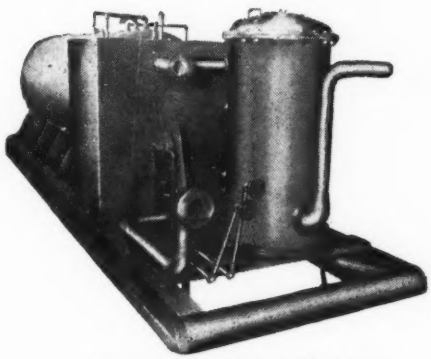
ENGINE AND GENERATOR MOUNTED ON A "PORTABLE" STEEL SUB-BASE



AIR STARTING EQUIPMENT AND SWITCHBOARD COMPACTLY MOUNTED ON STEEL SKIDS



PART OF ENGINE COOLING SYSTEM —A SKID-MOUNTED RADIATOR



FUEL OIL DAY TANK, ENGINE SUMP TANK AND FILTER, MOUNTED ON STEEL SKIDS

IDEAL FOR *HEAVY DUTY SERVICE* WHERE POWER *IS NEEDED FAST*

A 1250 KVA GENERAL MOTORS GENERATOR SET, Model 16-278A with *NEW* ELECTRIC MACHINERY MANUFACTURING COMPANY ALTERNATOR, 3 phase, 60 cycle, 2300 volts mounted on a fully portable, stress-relieved welded steel sub-base. All accessories are compactly mounted on steel skids to give the entire installation complete portability. The unit is designed so that it is a simple matter to erect anywhere and place in operation immediately.

900 KVA GENERAL MOTORS PORTABLE UNITS are also available. Investigate the possibilities of these compact and versatile power plants. Write for complete information today.

• *Diesel Power Plants available from 15 to 1,000 Kw.*

Engineered AGSCO DIESEL POWER

A. G. SCHOONMAKER ESTABLISHED 1895

Diesel Engines • Power Machinery *Company, Inc.*

50 CHURCH STREET, NEW YORK 7, N. Y. PHONE DIgby 9-4350

Our 43rd Year

WAGNER

Quality and Service

"CERTIFIED REBUILT"

THE MARK OF DEPENDABLE ELECTRICAL EQUIPMENT

MOTORS . . . GENERATORS . . . M-G SETS

PUMPS . . . FANS . . . BLOWERS . . . SPEED REDUCERS

PARTIAL STOCK LISTING—WRITE, WIRE OR PHONE YOUR REQUIREMENTS

M-G SETS

KW	Mfr.	Input V	Output V
150	Cr. Wheeler*	220/440 AC	250 DC
105	Century b.b.	220/440 AC	70 DC
100	Gen. Elec.*	220/440 AC	125 DC
100	Whse. converter	440 AC	250 DC
75	Whse.	220/440 AC	125 DC
75	Star b.b.*	220/440 AC	250 DC
75	Star b.b.	240 DC	230/460 AC
40	Whse.	220/440 AC	250 DC
40	El. Prod.	220/440 AC	125 DC
35	Gen. Elec.	220/440 AC	48 DC
30	Ideal	220/440 AC	125/250 DC
30	Elec. Prod.*	220/440 AC	50 DC
25	G. E. NEW	220/440 AC	125 DC
20	Whse.	220/440 AC	250 DC
20	Cr. Wheeler	220/440 AC	180 cycles
15	Gen. Elec.	220/440 AC	125 DC
9	H. V. W. 1500 Amp.	220/440 AC	6/12 DC

* Synch. motor drive.

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
150	Cr. Wheeler b.b.	TEFC	230	800
100	Whse.	SK181	230	450/900
75	G.E. New b.b. (2)	CDM	230	1750
75	Cr.W. New b.b.(5)	CMC	230	1150
75	Allis Ch.	E	230	500
75	Whse.	S13L	115	575
75	Gen. Elec.	BRC	115	1150
75	Northw'n.	K20	230	1750
65	Gen. Elec.	C	230	375/750
60	Allis Ch. New b.b.	FB149	230	520/690
60	Whse.	SK	230	1700
40	Gen. Elec.	RC32	230	1150
40	Whse.	SK	230	1700
40	Whse.	SK133	230	850
35/50	Gen. Elec.	CD123	230	575/1150
30	Whse.	S-7	115	900
30	Whse.	SK160	230	350/1000
30	Star b.b.	SB	230	1750
30	Gen. Elec	RC31B	230	1150
25	Gen. Elec.	RC31	230	1150
25	Sprague dyna.	LC	230	750/2000
25	Chand'son (4)	C13	115	850
25	G.E. b.b. NEW	CDM93	115	1150
25	Gen. Elec.	CD85	230	1750
20	Gen. Elec.	RF12	230	400/1600
20	Whse.	SK93	230	1150
20	G.E. b.b. NEW	CDM83	115	1750
20	Gen. Elec.	RC11	115	1150
20	Reliance	T	230	850
20	Gen. Elec.	DLC	230	500/1500
20	Gen. Elec.	CD85	230	1150
15	Gen. Elec.	LC	230	550/1100
15	Gen. Elec.	RC	115	1150
15	Roth	85RS	230	1750
15	G.E. b.b. NEW	CDM67	115	1750
15	Gen. Elec.	RC10	230	1150
15	Whse. (5)	SK90	230	825
15	El. Dyn. b.b. (2)	326	230	1750

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
600	Gen. Elec.	MPC	500	750
150	Cr. Wheeler b.b.	TEFC	250	1200
105	Century b.b.	1500a	70	1200
100	Gen. Elec.	RC17	125	1200
75	Allis Ch.	E	250	750
75	Whse.	S	125	600
40	Gen. Elec.	RC	250	1500
40	Whse.	SK	250	1150
30	Elec. Prod.	BB	50	1150
30	Gen. Elec.	RC	250	1500
30	Ideal 3 wire	HHR	125/250	850
25	G.E. NEW b.b.	CD33	125	1450
24	Whse.	SK	600	850
20	Reliance	T	250	1150
15	Gen. Elec.	RC	125	1200

EXPLOSION PROOF MOTORS—NEW

1—3 HP 1200 RPM	1—10 HP 900 RPM
2—7½ HP 1800 RPM	1—15 HP 1800 RPM
1—7½ HP 900 RPM	2—20 HP 1800 RPM
3—5 HP 1800 RPM	5— 5 HP 1200 RPM

A. C. MOTORS—25 CYCLE

H.P.	Mfr.	Type	Volts	Speed
300	Whse.	Synch.	440	750
150	Whse.	Synch.	440	750
150	Whse.	HF	440	500
50	G.E. int.	MTC5337	440	750
50	Allis Ch.	ANY	440	1500
50	G.E.	I-K	440	750

A. C. GENERATORS—60 Cycle

KVA	Mfr.	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
500	Allis Ch.	3 brg.	240/480	360
250	Whse.	G	2300	600
156	G.E. 1 brg.	ATB7558	240/480	1200
125	Whse.	G	240/480	720
125	Gen. Elec.	ATB	240/480	300
125	Whse. 25 cycle	G	240/480	750
112	Gen. Elec.	ATB	240/480	900
100	Whse.	G	2300	900
90	Fair. Morse	AB	240/480	900
63	El. Machy.	180 cy.	240/480	1800
56	Gen. Elec.	ATB	240/480	900
50	Cont. b.b.	S107	120/208	1200
31	Onan *New	GMCW	120/208	1800
25	Whse. b.b.	1 ph.	120/240	900
12½	Whse. b.b. NEW		240	1200

* Complete gasoline engine power unit.

A. C. MOTORS—SLIP RING

3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	600	Gen. Elec.	I-M	360
1—	300	G.E. 2200 V.	I-M	1800
1—	225	G.E. int. duty	MTC5564	600
1—	150	G.E. 2200/4000 V.	I-M	1200
1—	150	G.E. int. duty	ITC-15	720
1—	150	Allis Ch.	ANY	600
1—	100	Allis Ch.	ANY	1800
1—	100	Al. Ch. b.b. NEW	ARY	600
1—	450	Whse. 2200 V.	CW	600
1—	400	Whse. 2200 V.	CW	450
1—	100	Allis Ch.	ANY	720
2—	50	Allis Ch.	ANY	900
2—	25	Gen. Elec.	MT332	900
2—	100	Whse. int. 2200 V.	CI856C	600
1—	100	Allis Ch.	ARY	900
1—	75	G.E. int. duty	MTC5342	900
1—	75	Ideal int.	AVE	1200
1—	75	Gen. Elec.	MT558	600
2—	75	Gen. Elec.	IN-14	600
1—	75	Gen. Elec.	MT337	1800
1—	50	Howell	SR437	1200
1—	50	Fair. Morse	BV	720
1—	50	Gen. Elec. int.	ITC	600
1—	50	Whse. int.	CI	600
1—	50	Gen. Elec.	I-M	720
1—	40	Gen. Elec.	MT336	900
1—	40	Allis Ch.	ANY	450
1—	40	Gen. Elec.	MT327	1800
1—	37	G.E. int.	ITC	600
1—	35	Lancashire	b.b.	1800
1—	30	Gen. Elec.	OMT336	1200
1—	30	Gen. Elec.	MT346	600
1—	25	Triumph	SR	1200
1—	25	Gen. Elec.	I-M	600
1—	20	G.E. int.	MTC5312	900
1—	20	G.E. b.b.	MT503	1800
1—	20	P & H b.b. int.	WT8	1200
1—	20	Gen. Elec.	MT332	720
2—	20	G.E. int.	MTC5302	1200
1—	15	Gen. Elec.	MT502	1200
1—	15	P & H b.b. int.	W7	1200

A. C. MOTORS—SYNCHRONOUS

H.P.	Mfr.	Type	Volts	Speed
667	Gen. Elec.	ATI	2200	450
300	Whse.	G	2200/440	600
250	Ideal (2)	2BC-M4	2200	450
200	Gen. Elec.	TS	220/440	600
150	Gen. Elec.	ATI	2200	450
150	Gen. Elec.	ATI	220/440	300
150	Gen. Elec.	ATI	220/440	600
125	Whse.	G	2300	900
125	G.E. 80% Pf.	TS7556	220/440	900
125	G.E. splprf.	TS955	220/440	1200
100	American b.b.	YGH	220/440	900
60	Gen. Elec.	ATI	220/440	900

A. C. MOTORS—SQUIRREL CAGE

3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	500	Whse. 2200 V.	CS-32C	1800
1—	200	Reliance b.b. NEW	C6085	1200
1—	200	Reliance b.b. NEW	C6085	1800
1—	200	Allis Ch.	AN	1200
1—	150	Reliance b.b. NEW	14C6085	720
1—	150	Whse. 2200 V.	CS771-1C	1800
1—	150	Reliance b.b. NEW	B6085	1200
1—	150	Reliance b.b. encl.	AA	900
1—	125	Reliance b.b. NEW	C5085	1200
2—	125	Allis Ch. 2200 V.	AN	1200
1—	125	Gen. Elec.	IK-16	450
1—	125	Cont. 2200 V. b.b.	SC	1800
1—	125	Rel. TEFC NEW	B6085	1800
1—	100	Elec. Machy.	b.b.	1200
1—	100	Rel. TEFC NEW	C5085	1200
1—	100	G.E. b.b. NEW	K504S	1800
1—	100	Cont. TEFC	NP682	1200
1—	75	Reliance b.b. NEW	C5084	900
1—	75	Reliance TEFC NEW	C5084	1200
1—	75	Reliance b.b. NEW	C505	1800
1—	75	Gen. Elec.	KT329Y	3600
1—	75	Whse. hitorq	CS-607	1200
2—	75	Reliance b.b. NEW	C505	1200
2—	60	Reliance b.b. NEW	B504	1800
2—	60	Rel. TEFC NEW	C505	1200
2—	60	Reliance b.b. NEW	C504	1200
2—	60	Whse. H. T.	CS504	1800
1—	60	Wagner b.b.	RP444	3600
1—	60	Allis Ch. 4000/2200 V.	AR623	1800
1—	50	Whse. b.b. NEW	CS405S	1800
1—	50	G.E. 2 phase	I-O	900
2—	50	G.E. NEW b.b. HT	KG405	1800
2—	50	Reliance b.b. NEW	C445	1200
2—	50	Gen. Elec.	KT336	1200
1—	50	Gen. Elec.	KT342	900
2—	50	Whse. fislip	WL607	900
1—	40	Al. Ch. 3 speed	ARX	900/600/450
5—	40	Gen. Elec.	KT336	900
2—	40	Reliance b.b. NEW	C404	1800
2—	40	Rel. TEFC NEW	C445	1200
2—	40	G.E.	KT	1200
2—	35	Gen. Elec.	I-K	720
2—	30	Howell b.b. speed	SC	1800
2—	30	G.E. NEW b.b.	K365	1800
2—	30	G.E. NEW hitorq	KG365	1800
2—	30	G.E. TEFC b.b.	K404	1800
1—	30	Gen. Elec.	I-K	900
1—	30	Gen. Elec.	KT336	720
1—	30	Wagner	22T8P	900
1—	30	Whse.	CS646	900
2—	30	Reliance b.b. NEW	C405	1200
2—	30	Reliance TEFC NEW	C444	1200
3—	30	Cr. Wheeler b.b.	SC 20Y	1800
2—	25	Rel. TEFC NEW	C444	900
3—	25	Reliance b.b. NEW	C364	1800
2—	25	Reliance TEFC NEW	B365	1800
2—	25	Reliance b.b. NEW	C404	1200
2—	25	Reliance TEFC NEW	C405	1200
2—	25	Whse. NEW spl. b.b.	CS365	1800
1—	25	Gen. Elec.	IK	1200
3—	25	Whse.	CS646	900
2—	25	Gen. Elec.	I-K	600
1—	20	Reliance b.b. NEW	C404	900
1—	20	G.E. TEFC b.b.	K404	1200
1—	20	U.S. NEW b.b.	SC326	3600
4—	20	Reliance b.b. NEW	C364	1800
2—	20	L.A. NEW exp. prf.	EX364	1800
2—	20	Whse. NEW b.b. spl.	CS364	1800
2—	20	Gen. Elec.	KT312	1200
2—	20	Gen. Elec.	I-K	1200
1—	20	Whse.	CS	1200
1—	20	Gen. Elec. b.b.	I-K	900
2—	20	G.E. NEW b.b.	K365	1200
2—	20	Diehl TEFC NEW	INF364	1800
2—	20	Century b.b. 4 speed	SC594	1800
2—	15	Whse. Splashprf.	C3365	1200
4—	15	G.E. NEW b.b.	K324	3600
2—	15	Whse. NEW TEFC	CS326	1800
1—	15	Diehl TEFC NEW	INF365	1200
4—	15	Gen. Elec.	KT302	1200
1—	15	Gen. Elec.	KT512	900
1—	15	L. Allis	OX365	900

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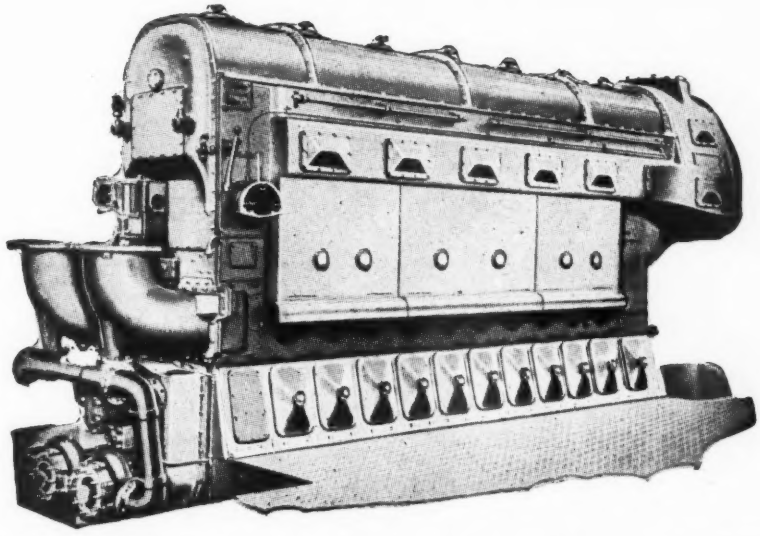

FAIRBANKS-MORSE 1600-HP. Model 38D8 ⅛, OP Cyldrs. 720-RPM. Diesel Engines Connected to NEW (Unused) Crocker-Wheeler 1250-KVA. Generators, Complete Units.
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DIESEL ENGINES

(10) 900 HP General Motors, Model 12-567 ATL, 12 cylinders, 744 RPM Diesel engines complete with auxiliaries. Practically new.

DIESEL GENERATOR UNITS

Alternating Current, 3 phase, 60 cycle

375 KVA Fairbanks-Morse, 240 volts, 300 RPM generator direct connected to 450 HP, 300 RPM, 6 cylinder, Model 32-E-14 full Diesel engine complete with switchboard.

(6) 125 KVA Westing., 450 volt, 1200 RPM, direct connected to Gen. Motors Diesel.

DIESEL GENERATOR UNITS

Direct Current

(4) 300 KW, 120/240 volts, 3-wire, 400 RPM Westinghouse direct current generators each direct connected to a 448 BHP Baldwin Diesel engine.

250 KW Crocker-Wheeler, 250 volt, 257 RPM generator direct connected to 360 HP, 6 cylinder late type Fairbanks-Morse full Diesel engine—complete.

125 KW G. E. 125 volts, 720 RPM generator direct connected 210 HP, 6 cylinder Fairbanks-Morse Diesel engine.

100 KW (6) Delco 3-wire, 250 volt generator direct connected to 150 HP, 1200 RPM, 8 cylinder Superior Diesel engine complete with switchboard.

SYNCHRONOUS MOTORS

300 HP 80% P. F. G. E. type ATI, 2300 volts, 720 RPM synchronous motor.

900 HP Allis 3 phase, 60 cycle, 2200 volts, 150 RPM synchronous motor.

STEAM ENGINE-GENERATOR UNITS

Alternating Current, 3 phase, 60 cycle

1125 KVA G.E. 480 Volts, 150 RPM generator direct connected to 28" x 36" Nordberg Unaflow Engine.

500 KVA G.E. 240 volt, 360 RPM generator direct connected Skinner vertical Unaflow non-condensing engine.

500 KVA Westg. 460 volts, 164 RPM generator direct connected to 26" x 28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pressure, 0 to 10 lbs. gauge back.

STEAM ENGINE-GENERATOR UNITS

Direct Current

400 KW (2) G. E. 250 volts, 360 RPM generator direct connected to Skinner Uniflow vertical non-condensing engine, 150 lbs. pressure, 10 lbs. gauge back.

275 KW Westinghouse 250 volt, 350 RPM generator direct connected to Ames vertical Unaflow engine.

200 KW, G.E. 125 Volt, 200 RPM generator direct connected Skinner Unaflow engine.

15 KW Crocker Wheeler, 125 volts, 410 RPM generator direct connected to an American Blower vertical engine.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers 550/600 volts, 300 RPM direct current generator direct connected 2190 HP, 3 phase, 60 cycle 4000/6600 volts synchronous motor.

400 KW Gen. Elec. 275 volt DC, direct connected to 710 HP. Gen. Elec. 3 phase, 60 cycle, 2300 volt, 720 RPM synchronous motor.

62½ KVA G. E. 3 phase, 60 cycle, 2300 volt, 1200 RPM alternator direct connected 75 HP, 3 phase, 60 cycle, 2300 volt motor.

50 KW Westg. 125 volt, 1200 RPM direct current generator direct connected 75 HP, 3 phase, 60 cycle, 2300 volt motor.

TURBINE-GENERATOR UNITS

3 Phase, 60 Cycle

1875 KVA G. E. condensing 250 lbs. pressure, 2300 volts, 3600 RPM complete.

1563 KVA Allis condensing 200 lbs. pressure, 600 volts, 3600 RPM complete exciter, condenser, switchboard.

1563 KVA G. E. condensing, 380 to 400 lbs. pressure, 2300 volts, 3600 RPM complete exciter, surface condenser.

1250 KVA Allis automatic extraction condensing 300 lbs., 25 lbs. bleeder pressure, 480 volts, 3600 RPM complete exciter, switchboard and condenser.

1250 KVA G. E. condensing, 250 lbs. pressure, 480/600/2300 volts, 3600 RPM complete shaft exciter, switchboard and surface condenser.

1250 KVA G. E. condensing 200 lbs. pressure, 4150 volts, 3600 RPM complete exciter, condenser, panel.

625 KVA G. E. condensing, 150-175 lbs. pressure, 480 volts, 3600 RPM complete exciter, switchboard, surface condenser.

625 KVA G. E. non-condensing, 150 lb. pressure, 15 lbs. back 2300 volts, 3600 RPM complete exciter, panel.

500 KVA Westg. non-condensing 150 to 250 lbs. pressure, 15 lbs. gauge, 240 v. complete exciter, switchboard instruments.

375 KVA (2) G. E. condensing 400 lbs. pressure, 450 volts, each complete exciter, switchboard, surface condenser.

375 KVA G. E. condensing 125 lbs. pressure, 2300 volts, 3600 RPM complete surface condenser and panel.

125 KVA G. E. non-condensing, 175 to 200 lbs. pressure, 10 lbs. gauge back, 2300 volts, 3600 RPM complete.

100 KVA Westg. non-condensing, 125 to 150 lbs. pressure, 10 lbs. gauge back, 2400/600 volts, 3600 RPM.

TURBINE-GENERATOR UNITS

Direct Current

(2) 400 KW, 240 volts direct current Crocker-Wheeler—Worthington 440 lbs. pressure condensing steam turbine-generator units.

200 KW (3) New General Electric 120 volt Marine type turbine generator units.

75 KW Allis Chalmers-Terry, 125 volts, 2400 RPM 150 lbs. pressure non-condensing turbine generator unit.

60 KW (3) new Westinghouse 120 volt Marine type turbine generator units.

ALTERNATING CURRENT GENERATORS

750 KVA Westinghouse 3 phase, 60 cycle, 460 volt, 150 RPM synchronous alternator.

560 KVA Allis 3 phase, 60 cycle, 240 volt, 360 RPM alternator.

500 KVA Westg. 3 phase, 60 cycle, 440/550 or 2300 volts, 514 RPM three bearing belted alternator.

400 KVA Allis 3 phase, 60 cycle, 480 volt, 240 RPM alternator.

300 KVA G. E. type ATI, 2300/440 volts, 720 RPM generator

200 KVA Westg. 3 phase, 60 cycle, 2300 volt, 257 RPM engine type alternating current generator with direct connected shaft exciter and switchboard.

SPECIALS

5425 GPM Worthington 70' head, 1800 RPM centrifugal pump direct connected to 125 HP G. E. 3 phase, 60 cycle, 2200 volt slip ring motor.

1 Allis-Chalmers jet condenser suitable for 2000 KW steam turbine-generator unit.

4400 sq. ft. Worthington surface condenser.

1250 sq. ft. Elliott surface condenser.

10 ton Capacity Brown hand operated traveling crane with 31'10" span including 150" of I-beams.

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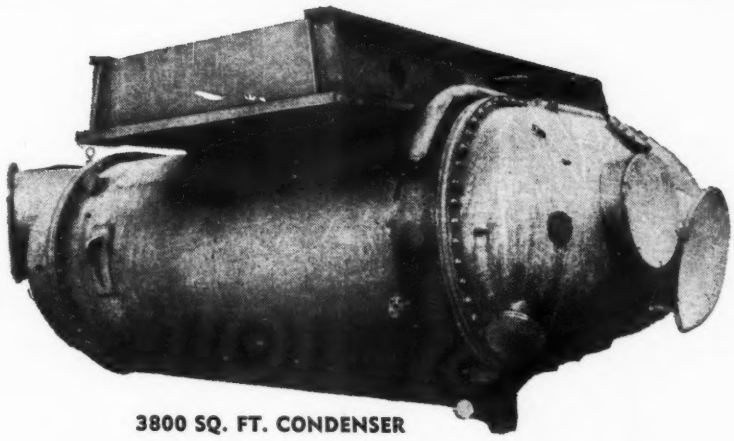

3800 SQ. FT. CONDENSER

CONDENSERS

(Most are new)

No.	Sq. ft.	Make	Passes	Tubes	
7	3800	Wheeler	1	Cu Ni	5/8"
4	3300	Str. Wells	2	Alu-Brass	3/4"
1	2200	Alco	2		
1	1135	Wheeler	2	Cu Ni	5/8"
4	1050	Conseco	2	Cu Ni	5/8"
1	750	Bethlehem	2		5/8"
30	400	All. Chalm.	2	Brass	5/8"
4	300	Wheeler	2		
8	155	Conseco	2	Brass	3/4"

BOILERS

10—Cleaver-Brooks, 2000# steam pr. hr. 35# press.
6—Cyclotherm 3000 pounds steam per hour, 125# press.
6—Express Boilers, modified D type, Foster Wheeler 30,000# steam/hr., 435#.
8—B&W, D type, 580# press, 5400 sq.ft. heating surface.

AXIAL FLOW FANS

12,000 CFM, 1" S.P. 3/60/450 Sturtevant
10,000 CFM, 3" S.P. 3/60/450 Clarage
5,000 CFM, 3" S.P. 3/60/450 La Del
35,000 CFM, 3" S.P. 230V. D.C. Wing
Rugged construction, acid resisting vanes, totally enclosed motors, all NEW

BLOWERS AND VACUUM PUMPS

1—Blower, Roots Connersville, size 20x23, serial No. 14685 with 350 HP motor 3/60/2200 (mfd. 1942).

8—Blowers, Roots Connersville, size 16x18, serial No. 14862, capacity 5000 CFM against 6 lb. sq. in. ga. pressure or 3450 CFM when creating 20" Hg vacuum, with 200 HP motors 3/60/2200 (mfd. 1942).

1—Air Pump, Ingersoll Rand, type FS546, 5500 CFM, discharge press. 24.22 abs., intake press. 20.61 abs., with 125 HP motor 3/60/2300 (mfd. 1942).

1—Air Pump, Ingersoll Rand, type FS548, 6690 CFM, discharge press. 20.86 abs., intake press. 17.10 abs., with 150 HP motor 3/60/2300 (mfd. 1942).

1—Blower, Buffalo, size 60, type R, with 150 HP motor 3/60/2200.

2—Blowers, De Laval serial No. 75221, 3200 CFM against 10 lb. press., with 176 HP motors, 230V DC.

4—Vacuum pumps, Nash Hytor, size MD574, with 2 HP motors 230V DC (mfd. 1944).

DISTILLING PLANTS

2—40,000 gallons per day, Foster Wheeler triple effect low pressure.
10—2000 gals. per day Kleinschmidt vapor compression distiller mfd. by Badger.
1—750 gals. per day, same as above.

MOTORS

3 Ph. 60 Cy.
6—3800 HP 1700 V 257 RPM G.E.
5— 700 HP 2300 V 128 RPM
D.C.
1500 HP 525 V DC 600 RPM W'hse.
667 HP 374 V DC 1300 RPM Elliott
444 HP 250 V DC 900 RPM Elliott
222 HP 230 V DC 3050 RPM W'hse.

GENERATORS

1200 KW 525 V DC 750 RPM All. Chalm.
1075 KW 375 V DC 750 RPM Elliott
700 KW 240 V DC 500/720 Elliott

TURBO-GENERATORS—A.C.

1—1000 KW All. Chalmers 3/60/600, 3600 RPM, cond., 140# steam press.
2—750 KW GE, Type AT1, 3/60/450, 1200 RPM, cond., 265# steam press.
2—450 KW, Whse, 3/60/450, 1200 RPM, cond., 250# steam press.
3—300 KW G.E. type AT1 3/60/450, 1200 RPM, cond., compl., with 40 KW exciters, condensers, switchboards.
2—250 KW G.E. type AT1 3/60/450, 1200 RPM, cond.
2—200 KW Westinghouse, 3/60/450, 1200 RPM cond. (NEW).
6—200 KW G.E. type ATB 3/60/450, 1200 RPM cond. and non-cond.
2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

TURBO-GENERATORS—D.C.

KW	Volts	Winding	Speed	Type
3—400	120/240	Shunt.	1200	cond.
2—375	180/240	Shunt.	1200	non-cond.
1—300	120/240	Compd.	1200	cond.
12—150	120	Shunt.	1200	cond.
20— 60	120	Stab. Sh.	1800	cond.
3— 25	120	Stab. Sh.	1200	cond.

FIRE PUMPS

2—1000 GPM, 280 ft. head, bronze, 6" x 5", Allis Chalmers, driven by Hercules Diesels, model DWXDS, 90 HP at 1800 RPM.
30—500 GPM, 120# press. at 2450 RPM, 750 GPM, 200# press. at 2900 RPM, with 160 HP White gasoline motor, 6 cycle, L-head type or 110 HP Cadillac, type V-8 (engines for sale separately).

STEAM TURBINE (new)

1—110 HP Sturtevant, 250# steam, 10# exhaust, 1200 RPM.

AIR COMPRESSORS

3—20 CFM of compressed air, 3000# pressure, Ingersoll Rand type 40 with 50 HP G.E. motors 3/60/220/440.

DIESEL ENGINES

HP	MAKE	MODEL	RPM	CYCLE	YEAR
1800	General Motors	16-258S	750	4	1943
1600	Fairbanks Morse	38D O/P	720	2	1944
1600	Hamilton	RB99-D.A.	700	2	1944
1600	General Motors	16-278A	720	2	1944
1200	General Motors	12-278A	750	2	1944
900	General Motors	12-567ATL	750	2	1942/44
500	Baldwin	6-cyl.	514	4	
300	Fairbanks Morse	38-O/P	1200	2	1936
225	Gray Marine	4¼" x 5"	2100	2	1943
150	Superior	GDB-8	1200	4	1942/44

DIESEL GENERATOR SETS

AC	200 KW	3/60/450	1200 RPM	General Motors	8-268A	1943 rebuilt
	100 KW	3/60/450	1200 RPM	General Motors	3-268A	1943 rebuilt
DC	1200 KW	525V	750 RPM	General Motors	16-278A	1943
	650 KW	240V	750 RPM	General Motors	12-567	1943
	125 KW	120/240	600 RPM	Superior	VDMB	
	100 KW	120/240	1200 RPM	Superior	GDB-8	1942/44
	100 KW	120/240	1200 RPM	General Motors	3-268A	1943/44
	10 KW	120	1200 RPM	Hercules	DOOD	1943

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WHAT POWER PLANT EQUIPMENT HAVE YOU FOR SALE?

POWER EQUIPMENT—READY TO SHIP

SAVE OVER 50% ON NEW INDUSTRIAL BLOWERS AND VENTILATING FANS

AXIAL FLOW VENTILATING FANS

5—50" dia. 7½" long, 2 sets of propellers, 3 blades to each. Dim: of blade, 14"x 9½" curved mfg'd by International. Size 114, driven by 100 HP., 1750 rpm., 220/440 v. 3 ph. 60 cy. A.C. Motor.

6—16000 CFM Buffalo Forge Co., 3" stat. pres. 1800/1200 rpm. con. 15/4.5 HP., 1710/1150 rpm., 3 ph. 60 cy. G.E. A.C. Motor 220/440 v. totally encl.

2—12000 CFM 3" stat. pres. Sturtevant with dir. con. 10/3 HP., 1775/1180 rpm., 220/440 v. West. CS. TEFC Motor.

1—7500 cfm Clarage with dir. con. 7½ hp., 1750 rpm., 3.3 HP. at 1160 rpm., 220/440 v. 3 ph. 60 cy.

31—6000 cfm Sturtevant Bulletin 512389, 3" stat. pres. 7 blade, dir. con. 5/1.5 HP., 1765/1175 rpm., 220/440 v. 3 ph. 60 cy. West. TEFC Motors.

2—5000 cfm Sturtevant 1.8 stat. pres. 4.2/1.25 HP., 1750/1150 rpm., 3 ph. 60 cy. 220/440 v. ball bearing motors.

2—4000 cfm 3" stat. pres. Sturtevant dir. con. 2 speed, TE Westinghouse 220/440 v. Motors.

A.C. MOTORS—3 PH. 60 CY.

No.	HP	Make	Type	RPM	Volts
1 new	500	Elec. Mach.	Syn	120	4000/2200 220/440
1	200	West.	CS	900	220/44
3 new	200	Elec. Mach.		1800	440
1	150	West.	syn.	450	220/440
1	150	West.	syn.	600	220/440
1	150	West.	syn.	900	220/440
2 new	150	Delco	syn.	1200	220/440
4	150	Louis Al.		1800	220/440
1	125	Elec. Mach.	syn.	164	220/440
1	125	West.	CS	580	2200/220/440
1	100	Reliance		495	220/440
3	100	Elec. Mach.	syn.	720	220/440
1	100	Allis Chal.		1200	220/440
5	100	Master	TEFC	1750	220/440
1	75	Stanley		600	220/440
1	75	Elec. Mach.	syn.	900	220/440
1	60	G.E.	KT	1800	550/440/220
1	50	Wagner		900	440/220
1	50	American		860	220/440
2	50	G.E.	K-405	1800	220/440

A. C. GENERATORS—3 ph. 60 cy.

1—450 Kva. Elec. Mach. 120 rpm.

2—NEW 125 kva. Delco, 1200 rpm.

2—115 kva. Elec. Mach. 720 rpm.

1—100 kw. Elec. Mach. 164 rpm., 220/440 v.

1—100 kw., West. 900 rpm., 220/220/440 v.

1—100 kw., West. 600 rpm., 220/440 v.

4— 25 kw., O'Nan, 1800 rpm., 220/440 v.

250 VOLT D.C. GENERATORS

No.	KW	MAKE	SPEED
3	250	Westinghouse	1200
2	200	Reliance	500
1	110	Westinghouse-SK	700
4	100	Reliance	580
1	100	Westinghouse	720
2	100	Westinghouse-SK-180	900
6	100	Delco	1200
11	100	General Electric-RC	850
1	100	Westinghouse-SK	850
1	100	Westinghouse-SK	2100
3	75	Crocker Wheeler	1350
3	75	Crocker Wheeler	1150
2	75	Westinghouse-SK	720
1	75	Crocker Wheeler	1400
1	60	Westinghouse-SK	1100
1	50	Westinghouse-SK-143	1100

BARGAIN — FOR SALE
100 KW. DIESEL ENGINE GENERATOR SETS

11—100 KW., 120/240 V. D.C. Delco Generators dir. con. to 150 HP., Model GBD-8, 5½x7, 8 cyl. Superior Diesel Engines, elec. starting with muffler, power panel and accessories.

Practically as good as new—Only Used for Spares.

MOTOR GENERATOR SETS—250 V.D.C.
Motors 220/440 volt or 2200 volt 3 phase, 60 cycle

No.	KW	MAKE	SPEED
1	5	Allis Chalmers	1200
1	5	Westinghouse	1150
1	7½	Westinghouse	1150
1	10	Westinghouse	1750
1	10	Allis Chalmers	1200
1	15	Crocker Wheeler	1750
1	20	General Electric	1200
1	20	General Electric	900
2	30	Westinghouse	1150
1	30	Reliance	850
1	30	Westinghouse	720
1	35	General Electric	850
2	50	Westinghouse	1150
1	60	Westinghouse	1100
1 new	75	Crocker Wheeler	900
1	75	Westinghouse	720
1	100	General Electric	2100
1	100	General Electric	1750
2	100	Delco	1200
1	100	Westinghouse	700
1	200	Westinghouse	720
1	200	Westinghouse	1150
3	250	Westinghouse	1200

VARIABLE SPEED MOTORS—230 V. D.C.

No	HP	Make	Type	RPM
2	200	Reliance	1970 T.	400/1200
1	200	West.	SK	400/1200
8	100	Reliance	1050T	400/1000
1	100	G.E.	RC-58	650/1200
2	100	West.	SK-183	575/1150
3	50	West.	SK-180	320/960
3	50	West.	SK	300/1200
1	40	Allis Chal.		400/1200
2	30	G.E.	DLC	460/1200
1	30	West.	SK-130	725/1450
1	30	G.E.	RA-32	800/1200
1	25	West.	SK-123	400/1600
1	25	West.	SK	500/1500
2 new	25	West.	SK-113	600/1200
1	20	West.	SK-110L	400/1600
1	20	West.	SK-123	400/1600

SLIP RING MOTORS—3 ph. 60 cy.

No.	HP	Make	RPM	Volts
2	800	West.	514	2200/6600
1	250	Allis Chal.	900	2200
1 new	200	G.E.	600	440
1	200	West.	1800	220/440
1	150	West.	1150	220/440/2200
1	100	Triumph	580	550/440/220
1	75	G.E.	720	220/440
1	75	G.E.	885	220/440
1	60	G.E.	720	220/440

SURFACE COMBUSTION GARDEN CITY HEAT TYPE EXHAUSTERS

3—#55 Single SSP, 14000 cfm at 1292 rpm., S.P. @ 70 deg. F and 8" water for 1200 deg. F. operation.

DYNAMOMETER

"Hi-Eff" hydraulic size 35#, model 58S, 3100 rpm., Taylor Mfg. Co.

SPECIAL BARGAIN AIR COMPRESSOR

6—240 CFM Westinghouse type 3 VS-23 3 cyl. vert., 150 lbs. pres. dir. con. to 50 HP., 220/440 or 2200 v. 3 ph. 60 cy. West Slip Ring Motors, auto. control. Can furnish D.C. Motors or Oil or Gasoline Engines if desired.

FREQUENCY CHANGERS

1—25 kw., 220/440 v. 3 ph. 180 cy., G.E. dir-con. to 25 HP., 1800 rpm., 220/440 v. 3 ph. 60 cy. motors.

SYNCHRONOUS MOTORS

1—New 500 HP., Elec. Machy. Co. 2200/220 or 440 v. 120 rpm.

ENGINE GENERATOR SETS

10—NEW 1 kw. 14.25 v. D.C. and 2 kw., 28.5 v. D.C. Homelite portable gas eng. Gen. sets. Can furnish lamps and batteries. Suitable for farms and camps.

3—5 kva. 120/240 v. 1 ph. 60 cy. Witte Diesel.

1—10 kw., 115 v. D.C. 1200 rpm., Hercules DIESEL.

30—NEW 25 kva. West. 120/208 v. 1 and 3 ph. 60 cy. LeRoi GAS.

1—35 kva. 220/440 v. 3 ph. 60 cy. 257 rpm., Ridgway STEAM.

1—125 kva. G.E. 220/440 v. 3 ph. 60 cy., dir. con. Skinner UNIFLOW Engine.

INDUCTION HEATING CONVERTER

New Van Norman, type indoor, floor, hi-freq. 32 kw. 220 v. 1 ph., 60 cy. 150 A. enclosed type.

HOISTS or WINCHES

200—1½ Ton HAND CRANKED ratio 27:1 thru an enclosed double reduction gear unit with 4 planetary gears mounted on steel plate complete with 48' of ¼" cable, ratchet type brake, push button release.

CAR PULLER or WINCH

1—Welen, 2 drum Winch or Car Puller rated 8600# per drum with 25 HP. G.E. Vertical Motor 230 v. D.C.

GEAR HEAD MOTOR

50 HP., G.E. 220/440 or 550 v., 3 ph. 60 cy., 1755 to 13 rpm., splash proof, ball bearing.

BRAND NEW TURBO SET

Westinghouse Steam Turbine consisting of 200 kw., 220/440 v., 3 ph. 60 cy. 1200 rpm., 80% P.F. A.C. Generator—40 kw., 120 v. 1200 rpm., D.C. Exciter and Westinghouse Reduction Gear. — Non-condensing.

SPECIAL ★ NEW A.C. MOTORS
Totally Enclosed—Fan Cooled
220/440 v. 3 ph. 60 cy.

No.	HP	Make	RPM
26	½	Dieh	1725
1	½	American exp. proof	860
10	¾	G.E.	1200
6	2	Louis Allis	1750
4	2	Louis Allis	1200
2	2	American	850
3	3	G.E.	1750
4	3	Allis Chal.	1150
7	5	G.E.	1750
25	5	G.E.	1150
1	7½	Louis Allis	1750
6	7½	G.E.	1200
6	10	G.E.	1750
3	10	G.E. vertical	1750
7	10	G.E.	1150
3	20	Louis Allis	900
1	50	G.E.	1750
2	75	Louis Allis	1150
5	100	Master	1750

PORTABLE COMPRESSOR

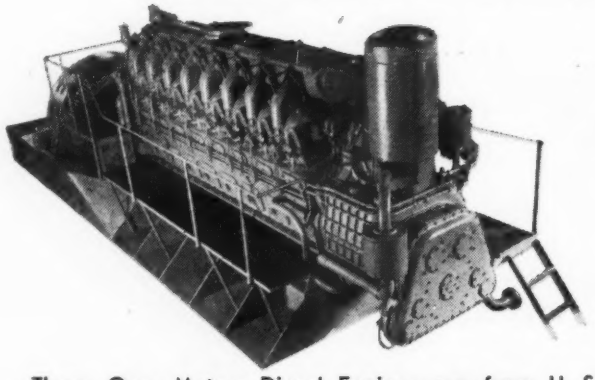
1—315 CFM Ingersoll Rand portable 100 lb. pres. driven by 105 HP Waukesha Oil Engines, 860 rpm.

FOR SALE OR RENT

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

DIESEL GENERATORS



1000 KW DIESEL GENERATING UNITS FOR QUICK DELIVERY

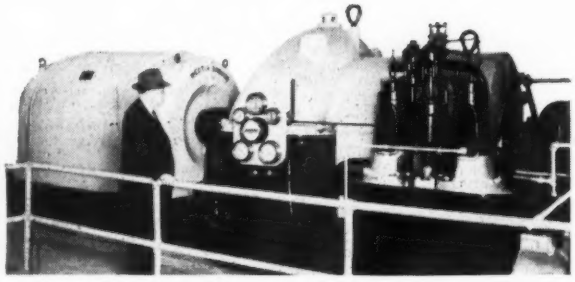
COMPLETELY RE-MANUFACTURED, 16 cyl., 1440 HP Gen. Motors 16-278A Engine dir. con. to NEW Electric Machinery Co. 1000 KW, 720 RPM, 80% PF, 3/60/2300 Generator. Complete with Air-starting Equipment, Heat-Exchange type Cooling, Switchgear Equipment and Base.

These Gen. Motors Diesel Engines are from U. S. Navy War Vessels built in 1942/44. Skilled mechanics rebuild them from top to bottom. All tolerances and wear-limits are expertly checked. NEW Gen. Motors replacement parts used wherever required. Can supply in other voltage and 50/60 cycles. We have other sizes. Ask us about them.

All units carry a one-year Guarantee.

Priced at about 1/2 of present newly manufactured Sets.

TURBO GENERATOR



JUST ONE AND ONLY ONE GOOD USED 3000 KW TURBO GENERATOR AVAILABLE

This is a Westinghouse, originally purchased from a U. S. Navy Power House. 200 psi, 100°F. Superheat, 3600 RPM, Ser. 6332 Turbine dir. con. to one 3000 KW, 3/60/2300, 80% PF, Westinghouse Generator. Inc. Rheostat, Condenser, Pump, Air Cooler, Exciter, Switch Gear, Ser. 2197695.

To Inspect it is to BUY it!

BOILERS

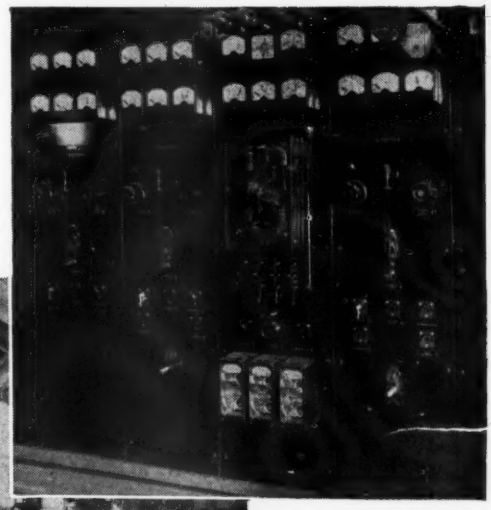
3 — 140,000#/hr. BRAND NEW COMBUSTION "VU" WATER TUBE BOILERS, EACH WITH SUPERHEATER, ECONOMIZER, FANS. COMPLETE. KNOCK-DOWN. 450 TO 600#. PROMPT DELIVERY.

1—125 HP Kewanee Economic Type, 125#, built 1942.
1—165 HP Keeler Cross Drum, 200#, Oil Burners, built 1935.
1—250 HP NEW Erie City Bent Tube, 2 Drum, 160#.
1—310 HP Keeler type "CP" Water Tube, with Stoker. Built 1942.
2—404 HP Springfield Sec. Hdr. Water Tube, Stoker. Built 1941.
2—480 HP Springfield Sec. Hdr. Water Tube, 100° Superheat, 250#.
1—508 HP Heine Bent Tube Water Tube, 4 Drum, 200#.
1—45,000#/hr. NEW Badenhausen, Bent Tube, 580#.

J. PARKER THOMPSON CO., INC.
Power Equipment
CABLE ADDRESS: "PARKTOM" NEW YORK
TELEPHONE: MURRAY HILL 7-6547
507 FIFTH AVENUE • NEW YORK 17, N. Y.

2 Complete, Modern

575 KVA SKINNER UNAFLOW ENGINE GENERATOR UNITS



2— 750 HP Skinner unaflow engines, each directly connected to 575 KVA Westinghouse 220 volt, 3 phase, 60 cycle, 150 RPM alternating current generator, with

15 KW "V" belt-driven exciters

Complete switchboard control apparatus, with switchboard operated variable speed synchronizing devices and automatic voltage regulators.

Also Available:

2— surface condensers with motor-driven circulating pumps.

2— 250 HP low pressure condensing steam turbines with auxiliaries.

This plant is one of the most modern medium-size steam power plants on the West Coast. It is complete in every detail.

The units were installed in 1935 and furnished complete power service for the building and presses of the Los Angeles Times. The plant has always been well maintained and is being removed from the Times Building now only because it is too small to furnish power for the building which is being enlarged to double capacity.

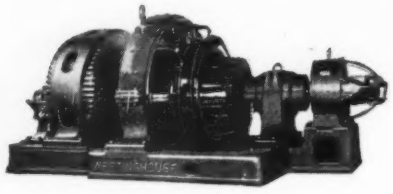
This complete steam power plant is offered for immediate shipment, F.O.B. Los Angeles. For further information write or telephone.

BEESON ENGINEERING CO.

1628 E. 7th Street • Los Angeles, 21, California

Telephone **MUtual 9151**

REBUILT BY CHICAGO ELECTRIC



Fine Items From One of The Nation's Largest Stocks Of Motor Generator Sets
Check These Units For Service, Economy and Prompt Delivery

Special Offering

MOTOR GENERATOR SETS

1000 KW generator, General Electric type MPC, compound interpole, 275 volts, 514 RPM, direct connected to, 1120 KVA synchronous motor, General Electric, type TS, 3 phase, 60 cycle, 4600 volt, 514 RPM, on fabricated steel sub-base. Complete.

500 KW generator General Electric, type MPC, compound interpole, 250 volts, 720 RPM, direct connected to, 710 HP synchronous motor, General Electric, Type ATI 3 phase, 60 cycle, 440 volts, 720 RPM, 3 bearing unit, on fab. steel sub-base.

TWO COMPLETE VARIABLE VOLTAGE DRIVES

Motor Generator Set—

200 KW DC generator, General Electric, type MPC 250 volts, 800 amps, 1200 RPM, direct connected to, 300 HP synchronous motor, General Electric, type TS, 3 phase, 60 cycle, 440 volts, .8 P.F. 1200 RPM.

D.C. Motor—

250 HP General Electric, type MPC, form A, 245 volts, 730/975 RPM. Complete Starting and Control Panels.

MOTOR GENERATOR SETS

KW	Make	AC Volts	DC Volts
1500	Al. Chlrs.	4000	550/600
1000	Gen. Elec.	4150	600
500	Gen. Elec.	2300/4000	600
500	Gen. Elec.	440	250
450	Gen. Elec.	2300	125
400	Ideal—3 unit	2300	125/250
300	Gen. Elec.	440/2300	250
300	Gen. Elec.	2400	250
200	Cr. Whlr.	2300	125
150	Al. Chlrs.	220	125
90	Gen. Elec.	2300	60
75	Star	220/440	230
75	Gen. Elec.	2300	125
75	Wstghse.	2300	110
75	Gen. Elec.	2300	250
60	Al. Chlrs.	2300	110
60	F. Morse	220	125
50	Wstghse.	220	110
50	Cr. Whlr.	240	230
40	Cr. Whlr.	220	125
40	Wstghse.	220	125
40	Cr. Whlr.	440	125
40	Reliance	440	250
35	Gen. Elec.	220	40
25	Wotton	220	97/111
22	Wstghse.	440	125
15	Columbia	440	45
15	Wstghse.	220	250
10	Reliance	440	250
10	Cr. Whlr.	220	125
8	Hertner	220	90/108
7½	Milwaukee	44	60
6	Gen. Elec.	220	230
5.25	Wstghse.	220	115
5	Cr. Whlr.	220	115
5	Ideal	220	115/230
5	Hertner	220	90/108

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	Speed
400	Wstghse.		2200	1750
350	Gen. Elec		440	720
250	Wstghse.	CS	2200	1800
200	Al. Chlrs.	New	440	900
150	Al. Chlrs	AR	440	1750
125	Gen. Elec.	TESC	440	1200
100	Al. Chlrs.	AR	440	514
75	Gen. Elec.	TESC	220	1800

D. C. MOTORS

HP	Make	Type	Volts	Speed
100	Gen. Elec.	RC	220	2500
100	Wstghse.	SK	230	625
75	Wstghse.	SK	230	850
60	Gen. Elec.	CD	550	1000

SLIPRING MOTORS

HP	Make	Type	Volts	Speed
3000	Gen. Elec.		2200	120
800	Wstghse.	CW	6600	507
600	Gen. Elec.	IM	440	352
400	Wstghse.	CW	2200	450
350	Gen. Elec.	IM	2200	720
300	Gen. Elec.	IM	440	900
200	Gen. Elec.	IM	2300/440	600
150	Gen. Elec.	IM	440	450
75	Gen. Elec.	IM	440	750

SYNCHRONOUS MOTORS

HP	Make	Type	Volts	Speed
1080	Wstghse.	25 cy.	6600	750
1000	Gen. Elec.	TS	2400	900
700	Wstghse.		440	900
300	Al. Chlrs.		4000/2300	600
250	Al. Chlrs.		2200	720
210	Elec. Mach.		440	900
200	Al. Chlrs.		2200	360
200	Al. Chlrs.		440	360

Remember! This Is Only A Partial Listing From Our Large Quality Stocks. We Can Furnish You With Any Item In the Electrical Power Equipment Field . . . . And Then Some

CHICAGO ELECTRIC COMPANY

1320 WEST CERMAK ROAD — CHICAGO 8, ILL. — CANAL 2900

POWER EQUIPMENT

NORTHERN METAL COMPANY — TOPS IN DEPENDABILITY

DIESEL ENGINES — DIESEL GENERATORS
TURBO GENERATORS

WE HAVE ON HAND ONE OF THE LARGEST INVENTORIES OF POWER EQUIPMENT IN THE EAST . . . . . .

MOTOR GENERATORS - STEAM ENG. GENERATORS - CENTRIFUGAL FANS - CENTRIFUGAL PUMPS
ROTARY PUMPS - RECIPROCATING PUMPS - MACHINE TOOLS - MOTORS A-C D-C - AIR COMPRESSORS

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NORTHERN METAL COMPANY

MILNOR & BLIGH STS. . . . SHIPWRECKERS . . . PHILADELPHIA 35, PA.
PHONE MA 4-1400

Actually one of AMERICA'S LARGEST STOCKS!

PARTIAL LISTINGS ONLY

Reliably Rebuilt—YEAR Guarantee

SQUIRREL CAGE MOTORS

H.P.	Make	Type	Speed
450	G.E. vert.	KF-6338	1180
250	G.E.	IK	1160
250	G.E. (2)	K-568	575
200	G.E.	KF-6335Z	880
147	West.	25 cy.	1750
125	West.	CS	600
125	Al. Ch. (2)	AR-630F	450
100	West.	CS-655C	1750
100	G.E. (2)	K-544	1175
100	G.E. (8)	K	1150
100	West.	CS	870
100	G.E.	K-6325	880
100	G.E.	KT-556	865
100	West. (2)	CS	690
75	West.	CS-505S	1760
75	West.	CS-662-C	1150
75	West.	CS	670
60	West.	504-S	1750
60	Rel.	AA-C5084Z	870
50	G.E.	FTR-523	3600
50	Elliott	196	3450
50	G.E.	K-445	1170
50	Century	SC-506	1160
50	West.	CS	860
40	G.E.	KT-336	900
40	West.	CS	900

Partial List Only !

SLIPRING MOTORS

600	Cr. Wh.		514
200	G.E.	MTP	1800
150	G.E.	MT-564Y	580
100	G.E.	IM	1800
100	Al. Ch.		690
75	G.E.	IM	690
60	Al. Ch.		690
60	G.E.	M-6326	705
50	West.	CW-554	1155
50	Al. Ch.	ARY	575
50	F-M	BV	575
50	G.E.	IM	490
40	G.E.	IM	1200

SYNCHRONOUS MOTORS

H.P.	Make	Type	Speed
600	G.E.	TS	900
400	G.E. (4)	TS-982S	600
260	G.E.	TS	900
200	Ideal (2)		257
150	G.E.	TS	1200
125	West.	G	1200
100	West.	G	1200
100	G.E.	TS	1200
100	Elec. Prods.		1200

A. C. GENERATORS

200 KW	West.	G	1200
150 KW	G.E.	ATB	360
75 KW	G.E.	ATB	1200

D. C. to A. C. GENERATORS

K.W.	Make	D.C.	A.C.
25	G.E.	230	220
25	Star	115	120
25	Ideal	115	440
25	El. Mchy.	230	440
7½	Hertner	115	440
5	El. Spec.	110	110

550 V. D. C. MOTORS

H.P.	Make	Type	Speed
765	G.E. (6)	MPC	1045/1350

230 V. D. C. Variable Speed Motors

150	Rel. (3)	1400-T	400/1200
100	Rel.	1050-T	400/1200
100	G.E.	CD-173	400/1200
75	G.E.	D	500/1500
75	Cr. Wh.	CMC-125H	375/750
60	G.E.	C	480/1100
55	Cr. Wh.	CCM-125H	165/500
50	West.	SK	500/1500
50	West.	SK	250/1000
40	G.E. (3)	CD-1441	400/1500
25	West.	SA	500/1500
25	Rel.	185-T	500/1500
25	G.E.	RF-13	400/1600
25	G.E.	RF-14	400/1200
25	G.E.	RF-14	300/1200
20	G.E. (6)	RF-12	400/1200
20	West.	SK	375/1500
15	West. (4)	SK-95	600/1500
15	E.D.		500/1500
15	West.	SK-120	350/1000
15	West.	SK	250/1000
15	West.	SK	500/1500
10	G.E.	RF-10	600/1800
10	G.E.	CD-83	600/1800
10	West.	SK	600/1200
10	West. (3)	SK	500/1500
10	G.E.	RF	400/1600
10	G.E. (3)	RF	400/1200
10	Rel.	131-T	250/1000
7½	West.	SK-70	500/1500
7½	G.E.	RF-10A	450/1600
7½	Al. Ch.		350/1050
5	West. (3)	SK-60	500/1500
5	G.E.	RF-9	450/1800
5	G.E.	RF	450/1800
5	Rel. (2)	46-T	400/1600

230 V. D.C. MOTORS

150	G.E.	RC-19	800
100	G.E.	RC-14	1750
75	West.	SK-170	635
75	West. (2)	SK-180	475
75	Cr. Wh.	52-HM	480
60	West. (2)	SK-160	680
50	West.	SK-133	1300
50	Diehl	K-10	850
50	West.	SK	750
50	West. (2)	SK-160	585
40	West.	SK-103	1750
40	Century	DN-454	1740
40	G.E.	RC	1750
40	G.E.	RC-32	1100
40	G.E.	RC-13	1075
30	G.E. (2)	RC	1200
30	West. (2)		975
30	G.E. (2)	RC-33	775
30	West. (2)	SK-143	575
20	G.E.	RC	1750
20	G.E. (2)	RC-11	1150
20	Star (2)	SR-316	29.2

115 V. D.C. MOTORS

100	Cr. Wh.	CMC	900
25	G.E (2)	CD	1800
25	Cr. Wh.	CCM	750
20	Century	RS	1750
20	G.E. (2)	CD-83	1750
20	West.	SK-110L	750
12½	G.E.	CDM-85	930/1160

600 V. Generator

K.W.	Make	Speed
200	Cr. Wh.	900
30	Burke	1750
30	E.D.	1150

250 V. Generator

K.W.	Make	Speed
500	West.	1100
330	Elliot	1200
300	G.E.	1200
300	Al. Ch.	1200
200	G.E. MPC	1200
150	West.	900
150	West.	1180
150	G.E.	600
50	G.E.	1200
30(3)	G.E.	1750
30	Cont.	1200
25	G.E.	1200
15	G.E.	1750
10	Star	1750
7½	West.	1200
5	West.	1750

125 V. Generator

K.W.	Make	Speed
250	G.E.	720
150	Cr. Wh.	1200
150	West.	1150
100(2)	West.	900
100	G.E.	1200
100	El. Mchy.	1200
75	Cr. Wh.	1200
75	Hertner	1150
50	Sturt.	2800
40	Cent.	1450
30	L.A.	1450
30	G.E.	1150
20	Delco	1200
15	G.E.	1150
10	Rogers	1450
7½	West.	1200
5	G.E.	1750

Low Voltage Generator

Amp.	Make	Voltage
8000	H-V-W.	6/12
6000	M-B-O'C	6/12
5000	M-B-O'C(2)	6/12
5000	Col.	8/16
2000	H-V-W.	6/12
1000	Chandeymon	6/12
1000	Col.	6/12
125	Hobart(8)	7½
3000	Chandysson	12/24
1000	H-V-W.	12/24
300	Star	15
67	Cont.	15
750	Star	15
1000	G.E.	15
800	G.E.	22/23
600	Rel.	24
134	West.	24
175	Cr. Wh.	25
550	Col.	27
1600	G.E.	30
800	G.E.	30
100	G.E.	30
200	West.	30
205	G.E.	32
1000	G.E.	33
205	G.E.	42
24	G.E.	44/54
75	G.E.	50/10
800	G.E.	50

TRANSFORMERS

300 KVA—Al. Ch. 3 phase, 4160 V. primary 230 V. secondary.
300 KVA—Pittsburgh, 3 phase, 4160 V. primary, 230 V. secondary.
300 KVA—G.E. 3 phase, 550 V. primary, 110/220 V. secondary.

NEW D.C. STARTERS

150—230 V. Magnetic 5 H.P. to 75 H.P. G.E.—C-H—A-B—W.L., etc.
100—230 V. Manual and Compound 1 H.P. to 5 H.P.—G.E. & C-H.
40—7½ H.P. 230 V. C-H—Magnetic reversing.

A.C. STARTERS

1—475 H.P. West. Magnetic Reduced voltage, 550 V. synch.
4—400 H.P. 440 V. C-H Bal. 9976 Mag. Red. Volt. Synch.
1—250 H.P. C-H. 4150 V. synch. full voltage.
1—150/200 H.P. G.E.—440 V. CR-7065 syn.
3—150 H.P. G.E. 220 V. Cr. 7061 Synch.

NEW A.C. STARTERS

40—C-H. & A-B 2 and 4 speed Magnetic up to 25 H.P.
20—50 H.P. C-H. 440 V. Magnetic.
165—20 H.P. W.L. 440 V. Magnetic.
635—7½ H.P. C-H. 440 V. Magnetic.

AIR COMPRESSORS

425 Cfm. Sullivan 2 stage.
360 Cfm. American 125 lbs.

ELECTRIC & AIR HOISTS

17—2 ton Shepard-Niles 230 V. D.C.
8—500 lbs. P & H. Zip Lift, 3 phase.
2—2 ton Yale & Towne, 3 phase.
1—1 ton Shephard-Niles, 3 phase.
1—½ ton Yale & Towne, 3 phase.
1—2 ton Thor, pneumatic.
1—½ ton Thor, pneumatic.

400 CY. GENERATORS

2—3 KW GE 3/400/110.
1—7½ KW GE 3/400/240.
1—10 KW GE 200/700 Cy.
1—15 KW GE 3/400/240.

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"BREW, WOLTMAN OFFERS"

TURBINE UNITS—60 Cy.

2—3625 KVA G.E. Cond. 25 Cy. 2300 Volts 1500 RPM 225-lb.
1—6000 KVA G.E. Cond. 2300/4000 Volts 1800 RPM 200-lb.
2—3750 KVA West. Cond. 2300 Volts 3600 RPM 150/200-lb.
1—3125 KVA West. Cond. 2300 Volts 3600 RPM 200-lb.
1—2000 KVA G.E. Cond. 6600 Volts 3600 RPM 200-lb.
1—1850 KVA G.E. Cond. 480 Volts 3600 RPM 150-lb.
2—1250 KVA G.E. Cond. 2300 Volts 3600 RPM 135-lb.
1—1250 KVA Al. Ch. Cond. 2300 Volts 3600 RPM 200-lb.
1—1250 KVA G.E. Non-C. 440 Volts 400-lb.
1— 625 KVA G.E. Non-C. 240 Volts 3600 RPM 170-lb.
1— 600 KVA Al. Ch. Cond. 480 Volts 3600 RPM 150-lb.

WATER TUBE BOILERS

1—2000 HP B. & W. 450-lb. Pul. coal and oil
1— 519 HP Titusville 200-lb. Stoker
2— 509 HP B. & W. 200-lb. Stokers
1— 500 HP Union City 400-lb. Pulverizer
1— 418 HP Comb. Engr. 400-lb. Stoker
2— 406 HP Union Iron Wks. 200-lb.

STEAM ENGINE UNITS—60 Cy.

1—900 KW Nordberg Uniflow
1—450 KVA Ames Uniflow
1—400 KVA Murray Corliss
1—300 KW Skinner Uniflow
2—250 KVA Skinner Uniflow
2—200 KW Skinner Uniflow
1—156 KVA Ames Vert. Uniflow
1—125 KVA Ames Uniflow

D. C. STEAM ENGINE UNITS

2—750 KW Skinner Uniflow 250 V.
1—300 KW Skinner Uniflow 275 V.
1—275 KW Ames Vertical Uniflow 250 V.
1—200 KW Skinner Uniflow 250 V.
1—200 KW Skinner Uniflow 125 V.
1—100 KW Skinner Uniflow 230 V. 3-wire
1— 75 KW Ames Uniflow 125 V.

DIESEL ENGINE UNITS

6—1600 HP Fair. Morse 60 cy. 2300 V. NEW gen.
7— 720 HP Amer. Loco. 240 V. DC
1— 625 HP Worth. 240 V. 60 cy. gen.
1— 600 HP Fair. Morse 2400 V. 60 cy.
1— 450 HP Buckeye 450 V. 60 cy. gen.
1— 400 HP DeLaVergne 2400 V. 60 cy. gen.
1— 375 HP Worth. 240 V. 60 cy. gen.
1— 240 HP Fair. Morse 2400 V. 60 cy. gen.

SYNCHRONOUS 1700 MOTORS—60 Cy.

2—3000 HP G. E. 1700 V. 257 RPM
1— 880 HP G. E. 6600 V. 514 RPM
3— 400 HP Elec. Mcy. 440 V. 600 RPM
1— 350 HP G. E. 4800 V. 225 RPM
1— 300 HP G. E. 2300 V. 600 RPM
1— 300 HP West. 2300 V. 900 RPM
4— 150 HP West. 2200 V. 400 RPM
1— 100 HP G. E. 2300 V. 240 RPM (Super)

INDUCTION MOTORS

1—8000/1000 HP Cr. Wh. S/R 2200 V. FL 895/448 RPM
1—1200 HP Allis Chalmers S/R 2200 V 440 RPM
3— 350 HP Elliott S/C 2300 V. 900 RPM
1— 300 HP West. S/R 2200 V. 1800 RPM
3— 200 HP Elec. Mcy. S/C 480 V. 1800 RPM
1— 200 HP G.E. S/R 2200 V. 435 RPM
1— 150 HP Cr. Wh. S/C 440 V. 1800 RPM. NEW
1— 150 HP Al. Ch. S/C 440 V. 1200 RPM
1— 60 HP West. S/C 2300 V. 1200 RPM

MOTOR GENERATOR SETS

1—1500 KW Al. Ch. 600 V. DC 60 cy.
2—1000 KW Gen. Elec. 600 V. DC 60 cy.
2— 500 KW Gen. Elec. 250 V. DC 60 cy.
1— 400 KW Al. Ch. 275 V. DC 25 cy.
2— 300 KW Al. Ch. 275 V. DV 25 cy.
1— 200 KW Gen. Elec. 60 V. DC 60 cy.
1— 75 KW West. 125 V. DC 60 cy.
1— 75 KW Ridgway 115 V. DC 60 cy.
2— 75 KW Star 240 V. DC 60 cy.
1— 18 KW West. 60 V. DC 60 cy.

SYNCHRONOUS CONDENSER

1—500 KVA Westinghouse 3 ph. 60 cy. 2300 or 4600 Volts 900 RPM

ROTARIES—60 Cy.

1—2929/3705 KW Gen. Elec. 225/285 V.
1—2025/2565 KW Gen. Elec. 225/285 V.
1—2000 KW Allis Chalmers 600 V.
1—1500 KW Westinghouse 600 V.
2—1500 KW Westinghouse 270 V.
2—1000 KW General Electric 600 V.
1—1000 KW Westinghouse 240 V.
1— 750 KW Westinghouse 275 V.
1— 750 KW General Electric 600 V.
1— 500 KW Allis Chalmers 600 V.
1— 500 KW General Electric 275 V.
2— 300 KW Westinghouse 250 V.

FREQUENCY CHANGERS

1—6250 KVA G. E. 50/60 cy. 600 RPM
1—2000 KW G. E. 25/60 cy. 300 RPM
1—1000 KW G. E. 25/60 cy. 300 RPM
2—1000 KVA G. E. 25/60 cy. 300 RPM
1— 500 KW G. E. 25/60 cy. 300 RPM

TRANSFORMERS—60 Cy.

4—7500 KVA Al. Ch. 33000-13800 V. 3 ph.
3— 667 KVA Pittsburgh 33000-11000
3— 75 KVA G. E. 33000-2300 V.
3— 50 KVA G. E. 33000-2300 V.
3—3750 KVA West. 26400/13200-2400 V.
1—8000 KVA Penn. Auto 26400-13200 V. 3 ph.
4— 450 KVA Al. Ch. 25410/44000-13280/23000 Y.
3— 750 KVA West. 22000-2300/4600 V.
6—3000 KVA Al. Ch. Furnace 13200-200 V.
2— 200 KVA G. E. 11500-220/110 V.
3— 200 KVA Moloney 11000-2300 V.
3— 167 KVA G. E. 7200/12400 Y—240/480
1—1500 KVA West. Auto 4000-2300 V. 3 ph.
1—2500 KVA West. 2400-480 V. 3 ph.
1— 100 KVA G. E. 2300-575 V. 3 ph.
3— 250 KVA Al. Ch. 2300-460 V.
3— 20 KVA West. 2200-575/287½ V.
3— 7½ KVA G. E. 600-120/240 V.
4—27½ KVA G. E. 440-220/110 V.

OIL CIRCUIT BREAKERS

2— 800 A. 87 KV American BB Outdoor
1— 400 A. 37 KV West. G11 Outdoor
2— 400 A. 25 KV G. E. FK0136 Outdoor
2—1000 A. 23 KV Kelman CB76 Outdoor
4— 600 A. 15 KV G. E. FHK0139BS Outdoor

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1—3500 KW 2300 V. Cond
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1—2500 KW 600 V. Cond
1—2000 KW 600 V. Cond
1—1500 KW 2300 V. Cond
1—1000 KW 2300 V. Extrac.
2—1250 KW 2300 V. Cond
1—1000 KW 2300 V. Extrac.
1—1000 KW 2400 V. Cond
1— 750 KW 2300 V. Cond
1— 600 KW 240 V. Cond
1— 500 KW 550 V. Cond
1— 500 KW 480 V. Cond
1— 500 KW 480 V. Extrac.
1— 250 KW 2300 V. Cond
1— 150 KW 2400 V. N. C.
2— 125 KW 220 V. N. C.
1— 125 KW 600 V. Extrac.
1— 50 KW 220 V. N. C.
1— 50 KW 125 V. N. C.

BOILERS

1—150,000# 450# New
1— 30,000# 400#
1— 30,000# 425#
1—1030 HP 225#
4— 500 HP 200#
2— 500 HP 175#
2— 500 HP 400#
2— 480 HP 225#
2— 400 HP 180#
1— 400 HP 200#
1— 300 HP 200#
2— 250 HP 160#
1— 175 HP 15#
3— 158 HP 150#

TRANSFORMERS

3—500 KVA 13,800/575
3—200 KVA 600/220/110

ENGINE-GENERATORS

1—375 KW 2300 V. Uniflow
1—168 KW 600 V.
1—168 KW 220 V. Uniflow
1—150 KW 240 V.

AIR COMPRESSORS

1—6000 CFM 50# Motor
2—5600 CFM 50# Motor
1—1200 CFM 100# Motor
1— 700 CFM 100# Motor
1— 400 CFM 100# Steam
1—6000 CFM 5.1# New
1—5000 CFM 10# Rotor Type Syn. Motor 440 V.

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1—520 KW 360 RPM 550 V.
1—500 KW 225 RPM 550 V.
1—350 KW 300 RPM 550 V.
1—180 KW 600 RPM 550 V.

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300 KW G.E. 600 D.C. 1200 RPM. 6 PH. 60 CY. 2300/4000 V. TRANSFORMERS.

MOTOR GENERATORS

500 KW G.E. SYN. 250 V. 440/2300/4000 A.C. 900 RPM, 3 PH. 60 CY.

500 KW G.E. SYN. 600 V. 2300/4000 A.C. 900 RPM. 3 PH. 60 CY.

400 KW G.E. SYN. 250 V. 2300/4000 A.C. 900 RPM, 3 PH. 60 CY.

400 KW WEST. SYN. 600 V. 2300/4000 A.C. 720 RPM. 3 PH. 60 CY.

300 KW G.E. SYN. 250 V. 2300/4000 V. AC, 1200 RPM, 3 PH. 60 CY.

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DESIRABLE

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1—8000 KVA Westinghouse 2400 V surf. cond.
1—3750 KVA G.E. 480 V. cond.
1—2500 KVA Allis-Chalmers 2300 V cond.
1—1250 KVA G.E. 480 V mixed pressure

ENGINE GENERATORS

2—575 KVA Skinner Unaflow—direct connected to Westinghouse 240/480 V gen.
1—575 KVA Allis-Chalmers full releasing Corliss 480 V
1—375 KVA Ames vertical 220/440 V
1—275 KVA Ridgeway N.R.C. 2300 V
1—187 KVA Ames vertical
1—150 KVA Ames vertical 240 V

DIESEL ENGINES

General Motors, Fairbanks, Fulton, Nordberg and Buda from 15 to 1000 KW New and Rebuilt

ELECTRICAL EQUIPMENT

Large stock of Transformers, Motors, M.G. Sets, and Generators

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For Complete Specifications

LARGEST STOCK OF MODERN POWER PLANT EQUIPMENT ON THE PACIFIC COAST

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NETWORK TRANSFORMERS

19—150 KVA, GE, type Ht. late type, oil or pyranol cooled, 3 ph., 60 cy., 27660/125/216Y Mult or submersible type; attached to each transformer is GE automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.

8—200 KVA, GE, type Ht. late type, oil or pyranol cooled, 3 ph., 60 cy., 27060/125/216Y Mult or submersible type; attached to each transformer is GE automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.

PHILA. TRANSFORMER CO.
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1350 HP FAIRBANKS MORSE DIESEL PLANT

Consisting of 1-150, 1-300, 2-450 HP Model 32E late model units. Direct connected 2300 volt generators. Complete plant with all operating auxiliaries.

Immediate delivery.

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45 KW M.G. Set 2200 AC 250 DC
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285 KW 240 volt Chuse Uniflow engine set
200 KW 480 volt Ridgway engine set
2500 KW 2300 volt G.E. Cond Turbine set
200 KW 1800 rpm 440 volt TEFC Motor

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MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

LARGE STOCK OF A.C. and D.C. MOTORS

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn	H.P.	Speed	Volts	Make	Type
6	7½	810	550	G.E.	MTC-5201
1	7½	575	220	G.E.	MT-522
2	10	1149	440	West.	HF-7A
2	10	570	220	G.E.	HI-11
2	11‡	810	550	G.E.	ITC-5008
2	15	1160	440	West.	CW-464C
2	15	570	220	West.	CW-646
1	18	680	440	West.	NW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	850	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	1130	440	G.E.	MT-326
1	30	865	440	West.	CW-646
1	30	850	440	G.E.	MT-332
1	30	675	440	G.E.	MT-336
2	35	600	440	F-M	HV-H16A
2	40	865	2200	Al.-Ch.	ARY-223C
1	40	560	440	G.E.	MT-346
2	50	1150	440	G.E.	M-536
1	50	869	440	West.	HF-12A
1	50	570	440	G.E.	MT-552
5	52‡	550	220	G.E.	IQC-5013***
1	60	685	440	West.	CW-758
1	0	570	550	G.E.	MTC-5546
1	0	345	550	West.	CW
1	75	720	550	G.E.	MT-556
1	80‡	575	440	G.E.	MTC-5352
1	100	690	440	G.E.	MTC-5552
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
2	250**	296	220/ 380††	West	CW-20-53-15
3	300	900	140	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
2	300**	360	440	West.	CW-20-53-15
2	350	880	2200	G.E.	IM-17A
1	400	505	550	West.	CW
1	650**	360	440	G.E.	MT-442Y
1	700	735	4000‡‡	West.	CW

All 220 volt motors can be reconnected for 440 volts and vice versa.
‡ Intermittent rating. *** 2 phase.
** New. †† 50 Cycle. ‡‡ 25 Cycle.

230 Volt Constant Speed D.C. Motors

Qn.	H.P.	Speed	Make	Type
22	2	850	West.	SK-20
20	3	1160	West.	SK-20
10	3	850	Reliance	Y-23T
25	3½	850	West.	SK-30
3	7½	1750/1310	West.	SK-43
2	7½	1150	G.E.	CDM-66
3	7½	850	G.E.	CD-75
10	10**	1750	Kimble	BA-324
5	10**	1150	Al.-Ch.	EB-80
1	10	850	West.	SK-83
10	13½**	600	West.	SK-93
3	15	1750	G.E.	CD-75
5	15	825	West.	SK-90
1	20**	3500	G.E.	CD-75
1	20	1750	L.A.	ONA-L851
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-1101
17	25	825	West.	SK-120
2	30	1100	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	650	G.E.	RC-16
2	60	1750–1310	West.	SK-143
3	75	850	West.	SK-160
1	150	700	Al.-Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D.C. MOTORS

10	1½/2	500/200	G.E.	CD-65
1	2	225/900	Reliance	78T
1	5	450/1800	G.E.	CD-83
2	6	450/1800	G.E.	RF-9
6	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
1	12½	280/840	West.	SK-130
10	12½**	600	West.	SK-93
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20/25	300/1200	West.	SK-153
1	25	500/1500	G.E.	RF-12
1	23/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-163
1	30/40**	400/1600	G.E.	CD-1236
1	35	500/1500	West.	SK-143
1	40/50	400/1600	Al.-Ch.	ED-147
1	75	500/1500	Cr.-Wh.	CCM
1	75	375/750	Cr.-Wh.	CMC-125H
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al.-Ch.	
1	100	320/960	West.	SK-200
1	175	230/750	West.	SK-220
2	375	350/500	G.E.	MPC

** New.

VARIABLE VOLTAGE DRIVES

40 HP. Reliance, Variable Voltage Drives, each Consisting of:
1—40 KW. 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Totally Enclosed Fan Cooled, Ball Bearing

Qn.	H.P.	RPM	Volts	Make	Type & Frame
2	½	1750	220	R&M (TE)	L-184
1	½	1725	440	G.E.	K-63
4	1	1140	220	Howell	A-204
4	1.5	1150	220	L.A. (TE)	IS-225
5	1.5	1140	440	West.	CS-225
1	2	1735	220	G.E.	K-224
4	2	1140	220	L.A.	JS-225Y
1	2	1100	440	West.	CS-225
1	3	3450	220	Howell	K-224
3	3	1160	440	L.A.	JS-254
1	5	3480	220	G.E.	K-225
2	5	1750	440	L.A.	JA-254
10	5	1730	440	G.E.	K-254
1	5	1720	440	Century	SCH-254
2	5	1165	440	L.A.	JA-284
5	7.5	1740	440	G.E.	K-284
1	7.5	1735	220	G.E.	KF-284
1	10	3480	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	10**	880	220	West.	CS-365-EXPF
1	15	1745	440	West.	CS-326
1	15	1175	440	L.A.	JA-365
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504

Splashproof, Ball Bearing

1	2	1735	440	G.E.	K-224
1	3	1160	440	L.A.	FS-254
23	5	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
4	15	1150	440	L.A.	FX-365
3	30	3520	440	L.A.	FX-365S
2	40	1175	220	G.E.	K-445
3	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	125	1770	440	L.A.	FX-1078Y
1	150	1775	440	L.A.	FX-1168
3	150	880	440	L.A.	FX-1368
1	200	885	440	L.A.	FS-1378

Open Type Motors

Qn.	H.P.	Speed	Volts	Make	Type
5	2	170	440	G.E.	KT-926
4	2	1160	440	West.	CS-93C
1	2	690	440	G.E.	KT-944
10	5	1740	440	West.	CS-232C
1	7½	3475	440	West.	CS
1	7½	1750	440	West.	CS-250C
3	7½	1165	440	G.E.	KT-952
2	7½	870	440	West.	CS-370C
5	10**	1760	440	L.A.	OGA-324
5	10**	1750	440	West.	CSP-324
3	10	1160	440	West.	CS-370C
1	10	865	440	G.E.	KT-502
1	15	3485	220	Reliance	AA-B3247
5	15**	1735	440	Century	SC326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RPI-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KF-512
2	20	900	220	G.E.	FTR-522
1	25	1800	220	G.E.	KT-312
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	SCRB-356***
2	25	575	440	G.E.	KT-542
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3545	220	G.E.	KF-4048
3	40	1750	440	West.	CS-583C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	RP5-405
1	50	850	220	West.	CCL
2	60**	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-346
1	75	1160	440	West.	CS-662C
1	75	870	220	West.	CS-766A
1	100	690	220	West.	C
1	100	580	2200	G.E.	IK-15A
2	100	500	2200	West.	CS-930
1	100	495	2200	Al.-Ch.	AN
2	125	435	440	Al.-Ch.	AR
2	125	400	2300	G.E.	I-17-FR
2	200	580	550‡‡	G.E.	KT-566S
1	500	1200	440	G.E.	KTP-567
1	700	1800	2300/4000	West.	CS-4-39D-12

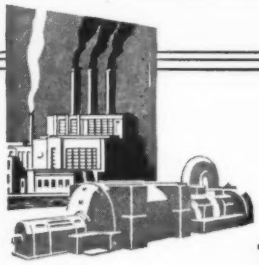
All 220 volt motors can be reconnected for 440 volts and vice versa.
** New. *** 2 Phase.
‡‡ Reconnectable for 440 volts.

CRANE, MILL TYPE 230 V. D.C. MOTORS

Qn.	H.P.	Speed	Make	Type
2 (115 v.)	3½	700	G.E.	CO-1803
2	5½	760	West.	MCB-20
1	6½	680	West.	K-3
1 (new) 6/ 7		1050/900	West.	K-2
1 (new)	10	650	G.E.	MD-403-BE
1 (new)	20/25	515/460	West.	K-6
1 (new)	20/25	975/875	West.	K-5
3	25	590	Diehl	TE
2	27½	535	West.	K-7
2	35	750	G.E.	CO-1828
3 (new)	35	600	West.	CK-9
1	50	750	G.E.	CO-1829A
1	50	600	West.	CK-9
5 (new)	50	525	G.E.	COM-1830AE
1	59	470	G.E.	CO-2007
2 (new)	69	550	G.E.	COM-1831 A E
4	65	450	G.E.	COM-1830

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located In Our Cleveland Warehouse. We Have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.
4521 HAMILTON AVE. CLEVELAND 14, OHIO



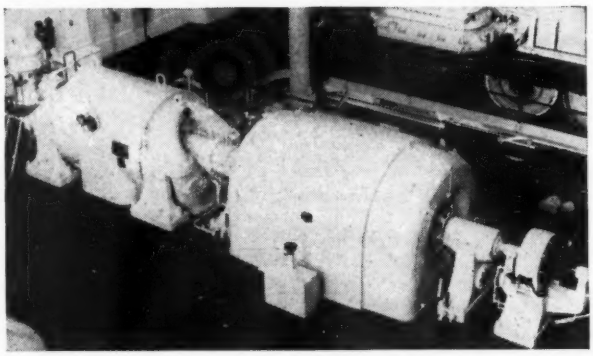
SPECIAL

TURBO GENERATOR

6000 KW

UNITY POWER FACTOR

OUTLINE DATA ISP 240#, 500° F total temperature, condensing, 60 cycle, 3 phase, 2400 volts. Surface condenser, panel board, meters, breakers, pumps, complete auxiliaries.
TURBINE Westinghouse semi-double flow, 6000 KW. Rebuilt 1922 by Westinghouse with steel parts for this rating and steam conditions indicated. Spring, 1948, complete overhaul. 1800 RPM. Originally manufactured 1912.
GENERATOR 6000 KVA. 2400 volts, 1443 amperes. April, 1948: Field removed, field and stator thoroughly cleaned and sprayed, generator overhauled. 50 KW shaft exciter.
CONDENSER 13,000 foot, Worthington surface condenser, with pumps, air ejector, etc. Radojet with inter condenser.



AUXILIARIES Complete and standby provided for most.

ITEM NO. 62 **300 KW, 375 KVA Westinghouse TURBO Generator.** 1927. 150# condensing. 120/208 volts, 3 phase, 60 cycle, surface condenser. Rebuilt and rewound by Westinghouse 1941. Not used since.

ITEM NO. 1494 **1000 KW Turbine Plant, built 1928. 750 Kilowatt, 937 KVA Kerr-Allis TURBO GENERATOR,** 150# condensing, 480 volts, 3 phase, 60 cycle. **Plus duplicate unit for standby** with **One** 1500 foot surface condenser, auxiliaries.
200 Kilowatt, 250 KVA Kerr-Allis TURBO GENERATOR, 150# non-condensing, 10# G.B.P. Exciters, MG sets, switchgear, piping, crane.

ITEM NO. 1625 **1000 KW, 1250 KVA Westinghouse TURBO GENERATOR.** 1933. 250#, 600° TT, condensing, 600 volts, 3 phase, 60 cycle. Surface condenser.

ITEM NO. 1638 **1500 KW, 1875 KVA Westinghouse TURBO GENERATOR**—1924. 250#, 600° TT, condensing, 2400 volts, 3 phase, 60 cycle. Surface condenser, exciter, switchgear, etc.

ITEM NO. 910 **600 Kilowatt Skinner UNAFLOW ENGINE GENERATOR.** 1927. 200#. 480 volts, 3 phase, 60 cycles.

ITEM NO. 3 **750 HP Union Iron Works, 3 drum, BOILER.** Built 1927. 250# W.P. Westinghouse stoker fired. New tubes.

ITEM NO. 1118 **400 HP. 30,000#/hr. Springfield Sectional Header BOILER.** Built 1930. 375#, 675° TT. Oil and gas fired. Walkways, and gratings, fans, valves, fittings, etc. Ship in 10 days.

ITEM A **Ten Combustion Engineering UNDERFEED STOKERS.** 1942 & later. Some new, different sizes.

ITEM B **Two Fredericks RAM TYPE STOKERS.** NEW. 2400#/Hr. of coal.

ITEM C **Two B & W, Type E, PULVERIZERS**—Burners—1250#/Hr. each.

ITEM NO. 1521 **27,000 KVA total Westinghouse FURNACE TRANSFORMERS.** 1939. 13.2 KV primary. 160/240 secondary.

ITEM UO. 344 **4000 KVA Pennsylvania FURNACE TRANSFORMER.** 1942. 22 KV primary. 90/260 secondary.

ITEM NO. 1415 **Two 300 Kilowatt General Electric MOTOR GENERATOR SETS.** 250 volts D.C.; 2400 volts A.C. 1200 RPM. Rebuilt and guaranteed.
Two 400 HP Box Header BOILERS. 260 psig, 125° SH, stoker fired—coal and ash handling, etc.

ITEM NO. 952 **2000 KW Moore NON-CONDENSING TURBINE ONLY.** 1936. 185# ISP, 40# G.B.P. 3600 RPM. Condition excellent.

ITEM NO. 908 **5000 KW, 6250 KVA General Electric TURBO GENERATOR.** 1920. 165# ISP. Condensing. Surface condenser. Just **rebuilt,** rewound.

PAUL STEWART

MAin 5873
MAin 3427

UNION TRUST BUILDING • CINCINNATI, 2 OHIO

A DEPENDABLE SOURCE FOR YOUR ELECTRICAL NEEDS

SPECIAL OFFERING – OVERSTOCK MOTORS

New 220/440/3/60 Squirrel Cage Motors

QU.	HP	RPM	TYPE	SPECIAL PRICE, EACH
1	125	1760	Open, SB (440V)	$765.0
2	50	1750	Open, BB	387.00
8	7½	1170	Open, BB	113.00
12	2	1750	DP, BB	33.00
9	2	1150	DP, BB	40.00
10	1½	1750	Open, BB	44.00
30	1½	1750	DP, BB	20.00
13	1½	1150	K-225, TEFC	50.00

ALSO LARGE INVENTORY OF OTHER NEW AND REBUILT MOTORS, GENERATORS, CONTROLS. SEND FOR OUR LATEST STOCK LIST.

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CERTIFIED SERVICE & REPAIR SHOP FOR OWENS-CORNING FIBERGLAS

The A-C SUPPLY CO.
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AKRON, OHIO
Plant & Office Cuyahoga Falls, O.
Telephone (Akron) WAlbridge 1174

TRANSFORMERS

4—75 KVA., Single Phase, 60 Cycle, General Electric, Type H, Form KR., 13200/12540/11880-440 volts, #4999501-03-05 & 07.
3—37½ KVA., Single Phase, 60 Cycle, General Electric, Type H., Form KG, 13800/13110/12420-230/115 volts, #5512044, 5512042 & 5514263.
3—25 KVA., Single Phase, 60 Cycle, General Electric, Type H, Form KR., 13800/13110/12420-230/460 volts, #4835052, 4790944 & 4835056.
All the above transformers are ready for immediate delivery.

ARCHER & BALDWIN, INC.
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75 West Street. New York City 6, N. Y.
Tel.—BOwling Green 9-9275-9276.

ASME BOILERS Nat'l Bd.

2—404 HP sectional steel header cross drum Springfield, 10' settings, oil fired.
2—25,000# (normal rating) Stirling's pulverizers, 425#.
2—400 HP sectional header, underfeed stokers.
1—300 12' settings, 7 years old, stack & breeching for these 3 units.

H. P. BREARLEY
3423-91st Street Jackson Heights, N. Y.

FOR SALE

STEAM DRIVEN COMPRESSOR

LAID LAW DUNN GORDON — HORIZONTAL
2 cyl. single stage—Tandem 13/22 x 16 x 18 Compound Engine—Operate on 150# steam. Good condition.

FS-5180, Power
330 West 42nd Street, New York 18, N. Y.

TRANSFORMERS

1 KVA up to 200 KVA in stock

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St. Phila. 34, Pa.
Phone Ga. 5-0488

MOTORS • GENERATORS • TRANSFORMERS

MOTORS
3 PHASE—25 CYCLE—220/440 VOLTS

H.P.	Make	Type	Frame	RPM
50	Fairbanks Morse	H16B	Ball Bearing	750
75	Fairbanks Morse	H16C	B.B. Slipring	750
75	Gen. Elect.	IK	2200 volt	750
75	Gen. Elect.	IK		1500
100	Allis Chalmers			1450
150	Gen. Elect.	IK-17		365
150	Gen. Elect.	IK-16		480
150	Gen. Elect.	IM-16	Slip Ring	480
150	Allis Chalmers			1450
150	Gen. Elect.	KT	557	1455
400	Gen. Elect.	IM 17A	Slip Ring	730
500	Gen. Elect.	IK		485
600	Gen. Elect.	MT	Slip Ring	490
600	Westinghouse	CS		490

NEW TRANSFORMERS

3—75 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—100 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—100 KVA Niagara O.I.S.C. 2400/120/240 1 Phase 60 cycle with taps.
3—150 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—200 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.

REBUILT TRANSFORMERS

Qu.	KVA	Make	Cycle	Voltage
3	15	Wagner	25	4400/240/480
3	50	Pitts.	25	11000/2300
2	50	Kuhlman	25	11500/2300/230/460
1	50	Kuhlman	25	11500/115/230
2	50	G. E.	60	2400/120/2400
1	100	G. E.	25	4600/230/460
3	400	Pitts.	25	12000/110

FREQUENCY CHANGERS
All Sizes in Stock, 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 and any other high cycle if desired.

HORIZONTAL & DUPLEX
Compressor & Vacuum Pumps after Coolers, Filters

25 CYCLE MOTORS

1—1270 HP. Gen. Elect. Synchronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.
1—1900 HP. Gen. Elect. Syncuronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.

MOTOR GENERATOR SETS

2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP. 3 Phase 25 Cycle motors.
2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP. 3 Phase 25 Cycle motors —Will rewind for 60 Cycle operation.

ROTARY CONVERTERS

1—2000 KW Westinghouse Booster type Rotary Converter 230 Volt D.C.—3 to 6 Phase, 25 Cycle, 4600 Volt Transformer.
2—2500 KW Gen. Elect. Synchronous Converters, 270 Volt D.C.—Transformer 3 Phase, 25 Cycle, 11,000 volts.
2—3500 KW Gen. Elect. Synchronous Converters, 270 Volt D.C.—Transformers 3 Phase, 25 Cycle, 11,000 volts.

COMPENSATORS

3—100 HP. Cutler Hammer Panel Mounted. Reduced Voltage Cat. #9141-H1387 3/60/2300 volts.—New.
1—300 HP. Gen. Elect. Type CR 1034-K22. Reduced Voltage 3/60/440 volts—Rebuilt.

NEW MOTORS
300 New Gen. Elect. & Westinghouse Motors in stock from 1 to 100 H.P.

75 KW. FREQUENCY CHANGER
75 KW. Gen. Electric Frequency Changer. 3 phase 120 Cycle 220/440 Volts—direct driven by 60 HP. Motor 3/60/220/440 volts.

MOTORS

1—75 HP. Fynn-Weischel Synn. 3/60/440/1200 RPM.
1—100 Gen. Elect. Slipring Type I Form M., 3/60/440/900 RPM.
1—100 HP. Gen. Elect. Type K (New Motor) 3/60/440/1800 RPM.
1—100 HP. Westinghouse Slipring Type CW, 3/60/440/435 RPM.
1—100 HP. West. Slipring Type CW 3/60/440/1200 RPM.
1—100 HP. Gen. Elect. Slipring 3/60/440/1200 RPM.
1—200 Gen. Elect. Type KT. 572 3/60/440/600 RPM.
1—200 HP. Gen. Elect. Slipring Type I Form M. 3/25/440/500 RPM.
1—500 HP. Allis Ch. Slipring 3/60/2200/514 RPM.
1—500 HP. Gen. Elect. Type I Form K. 3/25/440/485 RPM.
1—600 HP. West. Motor Type CS, 3/25/550/490 RPM.
1—600 HP. Gen. Elect. Slipring Type MT, 3/25/550/490 RPM.

VARIABLE SPEED MOTORS

2—300/150 HP. General Electric Motors Type BTA.—3 Phase 60 cycle 440 volts 560/280 RPM with controls.

3 PHASE 550 VOLTS 25 CYCLE MOTORS
Write for our stock list of approximately 500—3/25/550 Voltmotors

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL. 4758

STEEL STORAGE TANKS

6—74.000 & 35.000 Bbl. Vertical
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6—10.000 & 3—20.000 Gal. Horizontal

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60 E. 42nd St., N. Y., N Y

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
EBASCO SERVICES INCORPORATED
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HEADQUARTERS for GEARMOTORS

Brand New G.E. and U.S. 3 Phase 60 Cycle 220/440 Gearmotors in Stock

Guaranteed for One Year

5—	½ HP 100 rpm	3— 3	HP 350 rpm
10—	¾ HP 100 rpm	1— 5	HP 68 rpm
9— 1	HP 84 rpm	3— 5	HP 100 rpm
5— 1	HP 230 rpm	10— 5	HP 230 rpm
5— 1½	HP 68 rpm	2— 7½	HP 100 rpm
15— 1½	HP 280 rpm	5— 7½	HP 420 rpm
8— 2	HP 37 rpm	2—10	HP 100 rpm
6— 2	HP 230 rpm	4—10	HP 280 rpm
7— 3	HP 45 rpm	1—15	HP 84 rpm
4— 3	HP 280 rpm	4—15	HP 350 rpm

Also New Speed Reducers from ½ HP to 20 HP and Rebuilt Gearmotors from ¼ HP to 25 HP in Stock at All Times

Ask for price list

Prompt Detailed Replies to All Inquiries

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NEW ENGLAND'S LEADING MOTOR DEALER
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TURBO GENERATORS

TURBINE OF THE MONTH

1—1500 KW Westg. 400#, 700°F, condensing 3 ph., 60 cy. 2400 V. Surface condenser.

1—2000 KW G.E. 6600v, 3 ph., 60 cy. with 175 lb. cond. turbine and dir. conn. exciter

1—1500 KW Whse. 480v, 3 ph., 60 cy. with 160/175 lbs. Surface Condenser, panel & exciter

1—450 KW Whse 250 lbs. I.S.P. Surface Condensers—Auxiliaries—3 phase, 60 Cycle, 440 Volts. Direct connected Exciter Equipment built 1944.

2—1250 KW G.E. 2300v, 3 ph. 60 cy. with 175 lbs. condensing turbine

1—1250 KW Al Ch. 2300v, 3 ph., 60 cy. with 200 lb. condensing turbine surface condenser

1—1000 KW G.E. 2300/4150v, 3 ph., 60 cy. with 135/150 lb. condensing turbine

1—500 KW G.E. 480v, 3 ph., 60 cy. dir. conn. exciter with 80/100 lbs. I.S.P. 10/15 lbs. B.P., non-condensing turbine

2—500 KW G.E. 2400 v, 3 ph., 60 cy. dir. conn. exciter, 175 lbs. I.S.P. 10/15 lbs. B.P. non-cond.

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DIESEL ENGINE GENERATORS

Immediate Delivery

4—Fairbanks Morse O. P. MOD 38D8⅛—1600 HP direct connected to Crocker Wheeler 1250 KVA—1000 KW—3 PH—60 CY—2300/4000 Volt—720 RPM Alternaters with 10 KW direct connected Exciters.

3—Fairbanks Morse O. P. MOD 38D8⅛—1600 HP direct connected to Fairbanks Morse 1420 KVA—1136 KW—3 PH—60 CY—2300/4000 Volt—720 RPM Alternaters with 10 KW direct connected Exciters.

8—General Motors MOD 3-268A—150 HP, direct connected to Westinghouse 100 KW—3 PH—60 CY—480 Volt—1200 RPM Generators with direct connected Exciters.

2—General Motors MOD 3-268A—150 HP direct connected to Delco 100 KW—120/240 Volt, 1200 RPM 3 wire DC Generators.

2—Buda—MOD 6-DCG-844—105 HP direct connected to 60 KW—120 Volt—DC Generator.

2—General Motors MOD 8-268A—450 HP at 1200 RPM, Diesel Engines only.

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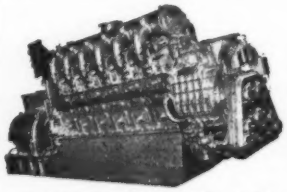
2526 GUARDIAN BUILDING DETROIT 26, MICHIGAN

Cadillac 1856



DIESEL

Generator Plants

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1000 KW, 2400 Volts, 3 Phase, 60 Cycle, 720 RPM, General Motors Model 16-278A.
750 KW, 2400 Volts, 3 Phase, 60 Cycle, 720 RPM, General Motors Model 12-567
600 KW, 2400 Volts, 3 Phase, 50 Cycle, 600 RPM, General Motors Model 12-567.
300 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A
200 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A
125 KW, 220/440/2400 V, 3 Ph, 60 Cy, 1200 RPM, General Motors Model 3-268A
125 to 900 HP Diesel Driven Right Angle Pump Drive Units 900 to 1800 RPM.
75 KW, 220/440 Volts, 3 Phase, 60 Cycle, 1200 RPM, Hercules Diesel DFXE
50 KW, 440 Volts, 3 Phase, 60 Cycle, 900 RPM, Fairbanks-Morse Model 36A 5½
100 KW, 3 Wire, 125/250 Volts DC, 1200 RPM, General Motors Model 3-268A
900 HP, General Motors Model 12-567, Propulsion Unit Complete

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125, 150, 250, 300, 350 HP Motors—Rebuilt
75 Ton 65' span O.E.T. Crane—Motors
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2—109 & 150 HP Kewanee Boilers—95% New
150 HP Code HRT & 35 HP Scotch Marine
1250 KW Non-condensing Turbo Gen. Set

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"Export Orders Carefully Executed"

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1—150,000# MODERN Steam Generator 450#
1—100,000# MODERN Steam Generator 650#
2— 30,000# MODERN Steam Generator 450#
2—1040 HP Heine Boilers—Super 200#
2— 825 HP B&WCo. Stirling—Super 200#
2— 600 HP B&WCO. Sectional—Super 200#
3— 450 HP B&WCo. Sectional Header 200#
3— 310 HP B&WCo. Stirling 180#
Also smaller Boilers & Fire Tube Boilers.

TURBO-GENERATORS

3—5,000 KW Turbo—Generators—Cond.
1—4,000 KW as above
2—2,500 KW as above
3—2,000 KW as above
2—1,500 KW same
2—1,250 KW same
2—1,000 KW same
1— 500 KW same
Non - Cond: — 300 - 500 - 750 - 1000 - 1500 - 2000 - 1700 KW.

FREQUENCY CHANGERS—600-1200-1500 KVA each.
MERCURY RECTIFIERS—TRANSFORMERS! Send Your Requirements—We may have it.
Send us your INQUIRIES for ALL POWER MACHINERY

CHARLES B. REARICK 30 CHURCH ST. NEW YORK 7

MOTORS • GENERATORS
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25 cy. 60 cy. D.C.

ALL VOLTAGES 1-1500 H.P.

NEW and REBUILT
BOUGHT and SOLD

ELECTRIC EQUIPMENT CO.

ROCHESTER 1, N. Y.

THREE WIRE D.C. GENERATORS

1—800 KW Whse reduction gear turbo-generator unit, type G EHNC, non-condensing, compound interpole, good commutator 125/250 V.
1—750 KW Whse generator only, single bearing. 550 RPM, compound interpole. 125/250 V. Splendid condition.

PHILADELPHIA TRANSFORMER CO.
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FOR SALE

Power plant equipment, Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

FOR SALE

One Fairbanks-Morse Diesel

120 HP, Style VA direct connected to FM alternator, 220 V, 3 Ph, 60 cy. 90 KVA. Good condition. Reasonable.

L. P. Ilgen, Brook Park, Lewisburg, Penna.

SEARCHLIGHT SECTION

SLIP RING MOTORS
3-Ph., 60 Cy.

HP	Volts	Make	Speed
450	440/220	Whse.	514
300	440/220	G.E. MTC	600
200	2200/440	G.E.	1200
200	440	G.E.	450
150	440/220	Whse. (2)	1800
150	2200/440	G.E.	1200
125	440/220	G.E.	600
125	440/220	G.E. (Hoist)	900
100	2200/550	G.E.	1800
100	440/220	G.E.	1200
100	2200/550	G.E.	1800
80	440/220	G.E. (MTC)	900
75	2200/550	G.E.	1800
75	440/220	Whse. 25 cy.	750
50	440/220	G.E.	900

SYNCHRONOUS MOTORS
3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	ATI	600
250	440/220	Whse.	HR	277
200	4150/2300	Whse.	G	1800
150	4150/2300	G	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	G.E.	TS	900
100	440/220/25 cy	G.E.	TS	375
100	440/220	Whse.	G	1800
75	440/220 (new)	Whse.	G	1800
75	2200/440	Whse.	GE	600

TURBO-GENERATOR

Generator, 62½ kva, 1200 rpm, 440/220 volt, Whse, direct connected through reduction gear to Turbine, 50 kw, 7300 rpm, non-condensing, 125/150 lbs. ga., pr.

AIR COMPRESSOR UNIT

1—13" and 8" by 10" Worthington FEATHER-VALVE, 285 rpm. 110 lbs. ga. motor-driven.

CIRCUIT BREAKERS

1—5000 amp., ITE, 3 pole, 600 v., air
2—2000 amp., GG E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse, 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
700	2300	Whse.	CS	1800
600	2300/440	G.E.	KT	1200
500	440/220	G.E.	IK	900
400	550	G.E.	IK	720
350	2200/440	Whse.	CS	600
300	2200/440	Whse.	CS	600
200	440/220	G.E.	TEFC	1800
200	2200/440	G.E.	KF	720
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
125 vert.	440/220	G.E.	KTP	1200
100	550	Cr. Wh.	Q	900
100	440/220	G.E.	KT	450
100	2200/440	G.E.	K	1200
100	2200/550	G.E.	KT	900
75	440	G.E.	KT	400
60	440/220 (new)	L. Allis	OGA	1800

A. C. GENERATORS

1—320 kva., 600 rpm., 440/220 v., G.E.
1—300 kva., 600 rpm., 2200/440 v., G.E.
1—225 kva., 600 rpm., 220/440 v., G.E.
1—150 kva., 1800 rpm., 2200/550 v., Whse.
1—112 kva., 900 rpm., 440/220 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
200	230	Cr. Wh.	CMC	890
150	230 (new)	Cr. Wh.	TEFC	900
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230 (new)	Whse.	SK	1150
75	230	Whse.	SK	850
75	230	Whse.	SK	1750

MOTOR GENERATOR SETS

1—150 kw., 250 v., 1200 rpm., conn. to 250 hp., 440/220 v., 3 ph., sq. cage Whse. motor.
1—100 kw., 250 v., 900 rpm., Cr. Wh., conn. to 150 hp., 440/220 v., sq. cage.
1—75 kw., 125 v., 1200 rpm., G.E., conn. to 120 hp. 2200/440 v., syn. motor.
1—75 kw., 250 v., 1200 rpm., Whse., conn. to 112 hp., 440/220 v., sq. cage motor.
1—50 kw., 250 1200 rpm., G.E., conn. to 75 hp., 440/220 440/220 v., 60 cy., G.E. syn. motor.
1—50 kw., 250/1200 rpm., G.E., conn. to 75 hp., 440/220 v., 60 cy., syn. motor.

TRANSFORMERS
60 Cy.

3—2000 kva., G.E., 25000-2300 volts.
3—1000 kva., G.E., 4160/7200-230/460 volts.
1—1000 kva., Al. Chal. 2400-120/240/208 volts, 3 ph.
3— 500 kva., G.E., 11000-460 volts.
1— 400 kva., G.E., 2300-230/115 v.
3— 250 kva., G.E., 6900/11950Y-600 volts.
3— 200 kva., G.E., 4800/2400-120/240 v., 1 ph.
1— 150 kva., Whse., SK, 13200-125/215 v., 3 ph.
3— 100 kva., G.E., 4600/2300-230/115. NEW.
3— 100 kva., G.E., 450-115/230 v., dry, 1 ph., new.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

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1—310 H.P. Keeler C.P. type.

1—16,000# hr. B & W integral furnace type.

Both boilers equipped with Detroit Roto type stokers, duplicate electric and turbine driven pumps. Also Permutit softener system, Cochrane deaerating heater, etc.

Boilers stamped A.S.M.E., 160# pressure. All the above installed new 1943. Location, Florida. THIS PLANT is completely intact in original location. Immediate delivery. Will separate if desired.

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4000 KW TURBINE GENERATING PLANT

Consisting of

1—2000 KW and 2—1000 KW General Electric, 3 phase, 60 cycle, 480 Volts, 3600 R.P.M. Condensing Turbo Generator Units. Complete with all Auxiliaries. General Electric inspection reports are available.

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Most all units still on foundation. Many may be seen operating

TURBO UNITS (NON-COND.)

625 KVA General Electric 2300/480 v.
625 KVA Al. Chal. 480/240 v.
375 KVA (2) General Electric 2300-480 v.
250 KVA GE 480/240 v., 400#
250 KVA General Electric 600 v.
125 KVA GE 240/480 v.—Moore 250#
115 KVA Wghse. 2400/480 v.—Sturtevant
62.5 KVA GE 240/480 v.—DeLaval
62.5 KVA GE 480/240 v.—Terry 310#

TURBO UNITS (COND.)

1875 KVA (2) General Electric 2300 v.
1250 KVA Wghse. 2300 v., 425#
1250 KVA General Electric 2300 v.
1250 KVA (2) Al. Chal. 4000/2300 v., 300#
750 KVA General Electric 240/480 v.

SURFACE CONDENSER

3500 sq. ft. Wheeler

DIESEL UNITS

375 KVA FM "32E-14"; 480/240 v.
250 KVA Elliott 240/480 v.—Buckeye
125 KVA Elliott 240/480 v.—Buckeye
156 KVA Ideal 240/480 v.—Buckeye
112 KVA Fairbanks Morse 32D-14
109 KVA GE 240/480 v.—Superior
93.8 KVA EM 480/240 v.—Superior

BOILERS

605 HP Union 3 drum 200#
508 HP Combustion 200#
507 HP Combustion 400#
469 HP Sterling 425#
406 HP Union (Heine) 200#
312 HP Sterling 180#
288 HP Combustion HRT 150#
255 HP Sterling 3 drum 170#
250 HP Erie City (Heine) 180#
238 HP (2) Scotch Marine 200#
200 HP (2) Vogt 160#
200 HP Erie City 3 drum 160#
125 HP (2) Scotch Marine 100#
110 HP Erie City 3 drum 160#
106 HP Locomotive Type 250#

STEAM ENGINE SETS, A. C.

1125 KVA GE 480/240 v.—Nordberg Unif.
400 KVA GE 2300/480 v.—Erie City poppet v.
312 KVA GE 2300/480 v.—Chuse 4 v.
187 KVA GE 480/240 v.—Chuse 4 v.
187 KVA Wghse. 240/480 v.—Ames Ver. Unif.
187 KVA GE 2300 v.—Chuse 4 v.
166 KVA Al. Chal. 480/240 v.—Ames Unif.
79 KVA Al. Chal. 480/240 v.—Ames Unif.

STEAM ENGINE SETS, D. C.

300 KW GE 250 v.—Skinner Uniflow
300 KW CW 125 v.—Skinner Uniflow
200 KW GE 125 v.—Skinner Uniflow
150 KW GE 125 v.—Skinner Uniflow
75 KW CW 250 v.—Ames Ver. Uniflow

TRANSFORMERS

Three 400 KVA Wghse. 2300-230/460 v.
Two 200 KVA Wghse. 2300-230/460 v.

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Other Boilers Also Available

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2—150 KVA. 60 CY. 1 PH. 2400-240/480 SCOTT TAPS.
6—100 KVA. 60 CY. 1 PH. 2400-240/120.
6— 75 KVA. 60 CY. 1 PH. 2400-240/120.
9— 50 KVA. 60 CY. 1 PH. 2400-240/120.
7—37½ KVA. 60 CY. 1 PH. 2400-240/120.
8— 15 KVA. 60 CY. 1 PH. 2400-480/240.

ALSO ALL TYPES OF AIR COOLED AND PHASE CHANGERS.

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TURBINES, GENERATORS For Sale!

1—500 KW Allis-Chalmer 3/60/600/3600 (Kerr Allis) condensing, complete with all pumps and switch board.
1—1000 KW Allis-Chalmer Extraction 3/60/480/3600 condensing, complete with pumps and switch board.
1—250 KW reduction gear 3.60/480 Speed 8400/1200 direct connected exciter. Switch board. Non-condensing.
1—300 KW Gen. Elec. Condensing, direct connected exciter. Generator 3/60/2300/3600.
1—Westinghouse 1250 KVA condensing with 3/60/2300 generator and direct connect exciter. Switch board and all pumps and accessories.
1—1500 Gen. Elec. condensing 17 stages with 3/60/2300/3600 generator and direct connected exciter, switch board, pumps and all accessories.
1—755 KVA horizontal generator, 2 bearings, direct connected exciter, 257 r. p. m.

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SPECIAL:

New Package Steam Generators—Fully automatic.
Designed to use light or heavy oil or gas.
Complete with all auxiliaries—Ready to install.
Sizes 30 to 250 H.P.—Steam Working Pressures—15#—100#—125#—150#—Delivery early 1949.

4—400 H.P. Water tube Boilers—225# S.W.P. Immediate delivery.

1—2500 K.W. Westinghouse Turbo Generator Set—Condensing—3 Phase, 60 cycles, 2400 volts. Immediate delivery.

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STEAM ENGINE GENERATOR

1—Harrisburg Foundry & Machine 22 x 28 operating 150# steam 5# B.P. direct connected to General Electric D.C. Generator Type LD-12, 300KW, 240V, 2 wire, 35° C Rise. In excellent running condition complete with switchboard.

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1—100 HP—Hewes & Phillips—Corliss Engine—16 x 30E—right hand; 100 lbs. initial steam pressure, 5 lbs. back pressure, 100 RPM, good condition. Available January 15, 1949.

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25 NEW APPROXIMATELY 10,000 GAL. CAP. R. R. TANK CAR TANKS, 81 IN. DIA. 37 FT. 2-⅜ IN. LENGTH OVERALL, BOTTOM SHELL ⅜ IN., TOP ¼ IN.—TESTED 60 LB. PRES. TANKS ARE ON STEEL FRAMES—LOCATED NEW JERSEY.

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1—10,000# new Shepard Form 23, Motor Driven Trolley Hoist PB control for 220 AC.
1—5 ton Alliance Gantry Charging Crane, 20' span for 220 volts DC.
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1—35 ton ditto, 70' span.
1—15 ton Ditto.
1—2000# Cap. Shepard New Form 8 Elec. Hoist for 110/1/60 AC.
1—30 ton Cap. Hand Powerhouse Crane, 40' span, very good condition.
1—880 KW Nordberg Westinghouse Diesel Generator Set for 2400/3/60 AC, comp. Very good condition.
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1—400 KW Nordberg Fairbanks Morse Diesel Generator, ditto.

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TURBO GENERATORS

1—500 K.W., 3 phase, 60 cycle, General Electric non-condensing.
500 KW., 3 phase, 60 cycle, 440 volt Gen. Elec. #39937 with surface condenser, evactor, and switchboard.
750 KW. Gen. Elec., 150 lbs. steam, 10-20 lbs. extraction.

MOTOR GENERATORS

100 KW., 125 volt Gen. Elec. to a 150 HP., 3 phase motor.
80 KW., 80 volt Burke with synch. motor and panels.
50 KW., 250 volt Westgh. to 3 phase synch. motor.

TRANSFORMERS

2—500 KVA, Pittsburgh, 33000 x 13200/6600.
3—400 KVA, General Electric, 13200 x 120/240.
2—150 KVA. Pittsburgh 2300 x 230/460 volt.
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Over 100 NEW Gen. Elec. up to 75 KVA., 450 x 120 volt.

DC ENGINE GENERATOR

150 KW., 125 volt Crocker Wheeler to a 4 cylinder vertical Ames engine.

MOTORS

Large stock AC & DC motors

CAPACITORS

50—15 KVA, 220 volt, 3 phase, new, General Electric

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3—25 KVA, 120 volt, 1 phase, 60 cycle, 900 rpm, Westinghouse, with exciters to LeRoi Gasoline engines with panels, etc.

All above equipment actually in stock. Send for our list of many other items we have.

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3—200 watt, General Electric, Rotary Converters. Input 115 volts DC, Output 2 phase, 60 cycle, 80 volts.
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1—15 KVA, Westinghouse, 1/3/6 phase, 60 cycle, 110/220 volts, 1200 RPM, 80% P. F. Generator.
1—25 KVA, General Electric, 3 phase, 60 cycle, 240 volts, 1800 RPM Generator.
1—7½ KW, Westinghouse, motor generator set. Input 3 phase, 60 cycle, 440 volts, Output 250 volts DC.
1—1 KVA, Westinghouse, Rotary Converter, Input 115 volts DC, Output 1 phase, 60 cycle, 110 volts.
1—2 KW, Westinghouse, Motor Generator Set, Input 3 phase, 60 cycle, 220 volts, Output 115 volts DC.
1—3 KW, Imperial, Motor Generator set, Input 3 phase, 25 cycle, 220/440 volts, Output 115 volts DC.
1—5 KW, Hertner, vertical motor generator set, Input 3 phase, 60 cycle, 220 volts, Output 55-110 volts DC.
1—5 KW, Burke, motor generator set, Input 3 phase, 60 cycle, 220 volts, Output 110 volts DC.
1—10 KW, Westinghouse, 125 volt DC, generator and panel.
3—8 KW, General Electric motor generator sets, Input 3 phase, 60 cycle, 440 volts, Output 16 volts, DC.
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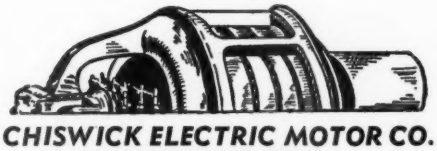

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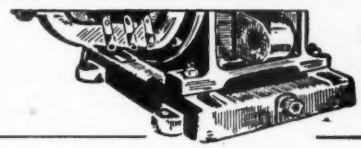

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3 ph. 60 cy. A.C. Motors
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Put all idle equipment to work. Send your list for prompt action. WRITE OR WIRE YOUR INQUIRIES

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1—18"x36" horizontal Corliss Steam Engine, with 12' dia. x 14" face flywheel and oiling devices — outboard bearings — belted fly ball governor direct connected to G.E. a.c., shaft mounted Generator #75481 — Type ATB, Class #24-200B-125 —Form E—125 r.p.m.—600 volts, 193 amps.

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1—24"-46"x48" horizontal cross compound Steam Engine with 17'6"x18" flywheel—belted fly ball governor—outboard bearings—direct connected to G.E. a.c. generator—shaft mounted Serial #66498—Type ATB —Class #32-750-94—Form E—550 Volts—786 amps.—94 r.p.m., with exciter.

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2—2100 HP, GE Synchronous motors, 514 RPM, 4600/2300 V, 3 phase, 60 cycle, 80% P.F. Complete with rheostats and belted exciters. Full details on application.
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Miscellaneous Distribution Transformers, Cable, Switches, Potheads and Electrical Instruments. Also Ross Carrier—hardly used. Arch measurements—91" high and 76" wide. 7 Ton capacity.

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3 PHASE—1 PHASE
15 to 62½ KVA

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D.C. MOTOR GENERATOR SETS TO 75 KW • HIGH CYCLE GENERATORS
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Two complete

VOGT 3 DRUM LOW-HEAD BOILERS

220 HP 160# Pressure Class ML-14 including combination oil and gas burners, combustion controls, feedwater regulators, boiler feed pumps, now installed in stand by condition.

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250 HP Terry steam turbine, in good condition.

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Mechanical or Electrical Degree—Minimum 4 years management experience supervising all power plant operations — responsible personnel, improvements, engineering etc.—age 35-45—nationally known Greater Cinti Manufacturer—salary completely open —replies confidential—write—

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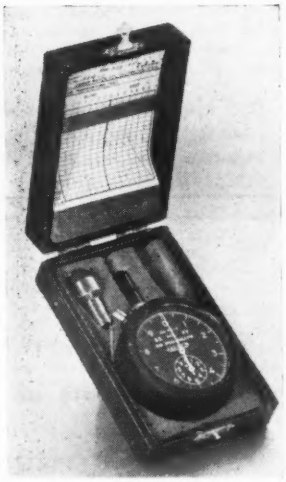

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- Ideally suited for testing the speeds of motors, particularly of fractional horse power, generators, turbines, centrifugals, fans, etc.
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- Unequalled Readability 2" Open face dial—each division on large dial equals 1 RPM; each division on small dial equals 100 RPM.
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Will give accurately, within a few seconds, by direct reading, the R.P.M. of shafts. Each unit comes complete in a velvet lined carrying case 5"x3½"x 1½". Net List Price $70.00—Surplus—Guaranteed. Your Cost $17.50 F.O.B. Chicago, Ill.

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AIR CONDITIONING UNITS
2—75 ton, Chrysler, Airtemp, NEW.
1—20 ton, Frigidaire.

BLOWERS
12—Axial Flow Fans 10000 CFM.
29—Axial Flow Fans 8000 CFM 3" SP.
12—Axial Flow Fans 3000 CFM.
3—1000 CFM ⅝" SP with Motors.
6—1200 CFM 13.9" SP with Motors.
3—3300 CFM ¾" SP with Motors.
1—5750 CFM 7½" SP, American.
6—10000 CFM 1.9" SP, Everdur Blades, Type R, Buffalo.
4—18000 CFM 7.¾" SP, V-Belted Type SE, #12 American.

BOILER PLANT
Complete plant, Erie City, 604 HP, 180 PSI, ASME code and Natl. Board. Pulverized coal fired, with coal bin and bucket elevator.

ELEVATORS—BUCKET
68' Centers, single 825 chain, 10"x6" MI Buckets, steel encased.
48' centers, single 825 chain, 14"x7" MI Buckets, steel encased.
46' centers, single 3½"x6" pitch chain, 7"x5" Buckets, steel encased with drive.
28' centers, single chain 188, 8"x5" MI Buckets, steel encased.

MOTORS
Large quantity NEW Gear Motors and X.P. from ½—75 H.P. available immediately.

PUMPS
Wilfley S.S. 3"x2½" 150 GPM 100' H.
Duriron 1½"x2" 50 GPM 40' H.
Duriron 3"x2" 300 GPM 108' H.
Duriron 4"x3", 290 GPM 90' H.
Deming, bronze 3"x2" 150 GPM 50' H.
F.M. 3"x3" 300 GPM 100' H.
Allis Chalmers 2½"x2" 200 GPM 140' H.
Chicago 4"x4" 500 GPM 88' H., C.I.

REDUCERS
4—Phila. 1½ HP, 1800 RPM, 5—1.
2—Boston 1½ HP, 900 RPM, 24½—1.
2—Boston 1½ HP, 900 RPM, 40—1.
1—Cleve. 3 HP, 1800 RPM, 50—1.
3—Falk 3 HP, 3450 RPM, 263—1.
8—Saco 5 HP, 1200 RPM, 10—1, size 6.
1—Farrell 5 HP, 875 RPM, 10—1.
1—Foote 5 HP, 1800 RPM, 40—1.
7—Link Belt 7½ HP, 1800 RPM, 19¼—1.
8—Saco 10 HP, 1200 RPM, 10—1.
1—Link Belt 10 HP, 1200 RPM, 16—1.
1—Phila. 10 HP, 1200 RPM, 67½—1.
1—Cleve. 15 HP, 1800 RPM, 5¼—1.
1—Phila. vert. 15 HP, 1800 RPM, 24½—1.
1—Cleve. 20 HP, 1800 RPM, 6—1.
1—Farrell 20 HP, 1200 RPM, 10—1.
2—Cleve. 50 HP, 1800 RPM, 5—1.
2—Cleve. 55 HP, 1800 RPM, 3½—1.
1—DeLaval 70 HP, 1800 RPM, 14½—1.

TANKS
750 gal. vert. 5'x8'x⅛" open.
2300 gal. hor. 5'x15'x⅛".
3500 gal. hi-chrome 77"x10'x⅝".
4000 gal. hor. 6'x20'x5/16" (2 NEW).
5000 gal. hor. 6'x23'7"x5/16" NEW.

TRANSFORMERS
500 KVA West. 4160-480.
200 KVA G.E. Pyranol, 2400-4160Y/240-120; 2400-4160Y/240-480.
100 KVA. West. 4160-208/120, 3 ph.
37½ KVA G.E. 4600-2300 (3 avail.).
25 KVA West. 450-117 air cooled, (10 available).
10 KVA. G. E. 2400-240/480.

WELDERS
300 and 400 amps. G.E. and Hobart, 3/60/220/440, rebuilt & guaranteed. New 1943 (200 available).

MISCELLANEOUS
Air Compressor—I.R., type 40, 194 CFM, 100 PSI, motor driven.
Crane—NEW, Overhead, 5 ton, 33'6" span, electric hoist, manual travel, complete with runways.
Diesel Generator Sets—60 KW G.M., 100 KW G.M. & Superior, 300 KW G.M.
Locomotive—Diesel elec. G.E. 45 ton, std. ga., rebuilt, New 1940.
Receiver—Air—5'x14' ASME U-69, 263 lbs.

Heat and Power Co., inc.
70 PINE STREET DIGBY 8-0373 NEW YORK 5, N. Y.

AVAILABLE FOR IMMEDIATE DELIVERY PERFECT CONDITION

1—750 KVA UNAFLOW ENGINE GENERATOR SET, right hand, consisting of:

1—G. E. 750 KVA Generator ATB-150 RPM-Form E, 600 KW, 3 phase, 60 cycles, 2300 volts. .8 PF.
1—Filer & Stowell 26 x 36 Non condensing Unaflow Engine, 175# steam pressure, 10# back pressure.
1—G. E. Belted 20 KW-125V, 725 RPM Exciter.
1—Switchboard for generator control.

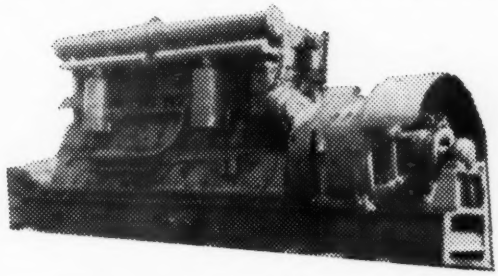
STILL SET UP AS OPERATED

Also—large assortment Motors—(chiefly GE Triclad), 3 phase, 60 cycle, 220-440V. including unused 3-60 HP 3500 RPM.

Send all inquiries to:
CONSOLIDATED PRODUCTS CO. INC.
P. O. BOX 299 Waverly, Iowa

FOR SALE—EXCELLENT CONDITION
PUMP
Emergency fire protection type, size 18"x10"x12"—1,000 gal. per min. double acting 100 lb. pressure.
GENERATOR
150 KW—250 volt D.C.—122 R.P.M. direct connected to 12"x36" compound steam engine.
Inspection on site AMERICAN BOOK CO.
300 Pike Street Cincinnati, Ohio

DIESEL GENERATOR



Generator mfd. by Burke Electric Co. Type WB-60 D.C. current. Specs. ABS serial #154830. 220-440 volts. 150 KW. 514 RPM constant speed 625 amps. Drip proof. Direct connected diesel engine, 275 HP-air starter Mfd. Atlas Imperial Engine Co. Wt. approx. 60,000 lbs. Our Price (F.O.B. Cinti., O.) **$8250.00**

CINCINNATI SALES COMPANY
205 Vine st. Cincinnati, Ohio DU 6220

We Are Offering for Immediate Delivery

PUMPS FOR SALE

2—De Laval 2 Stage, 600 G.P.M., Turbine Drive, 364 Foot Head, 140 Lbs. Steam Pressure, 1750 R.P.M., With Fisher Control.

2—Electric, 600 G.P.M., 364 Foot Head, 1750 R.P.M.

2—Electric 75 H.P. Motors, 280 Volts, 3 Phase, 6 Cycles.

2—De Laval Pumps, 2 Stage, 675 G.P.M., Turbine Drive, 462 Foot Head, 140 Lbs. Steam Pressure, 1750 R.P.M., Fisher Control.

1—Boiler Feed Pump — Byron Jackson make, 3x9 7 Stage, Terry type Turbine, 50 H.P., 150 Lbs. Pressure.

1—Byron Jackson 3x9 Type H.S., 200 G.P.M., 150 Lbs. Pressure, 1750 R.P.M., With 50 H.P., 280 Volts, 3 Phase, 60 Cycle Motor.

DEAERATOR

Capacity 100,000 Lbs. per Hr., 3/8" Shell, 7/16" Head Working pressure—30 Lbs. Complete with all auxiliaries.

ENGINES & GENERATORS FOR SALE

GENERATOR—K.W. 400, Volts 125, Amps. 3200, Westinghouse Electric & Mfg. Co.

ENGINE—Allis Chalmers Co.

GENERATOR—Amp. 4800, Speed 150, Volts 125, General Electric Co.

ENGINE—Skinner Engine Co., Erie, Pa. Universal Unaflow.

GENERATOR—K.W. 200, Volts 125, Amps. 1600, R.P.M. 100, Westinghouse Electric Mfg. Co.

ENGINE—Allis Chalmers Co., Milwaukee.

GENERATOR—K.W. 300, Volts 125, Amps. 2400, R.P.M. 100, Westinghouse Electric & Mfg. Co.

ENGINE—Allis Chalmers Co., Milwaukee.

MOTORS

(3) 40 HP— 900 R.P.M.—125 V, D.C.
(1) 40 HP—1800 R.P.M.—125 V, D.C.
(1) 30 HP— 900 R.P.M.—125 V, D.C.
(3) 20 HP— 900 R.P.M.—125 V, D.C.
(3) 10 HP— 900 R.P.M.—125 V, D.C.

Complete with cast iron motor base and pushbutton magnetic starters.

C. F. PIEHL COMPANY
2 W. 59TH STREET NEW YORK, N. Y. PLAZA 3-1740

DIESEL DRIVEN GENERATOR PLANT

300 KVA, Allis Chalmers 450 volt, 3 phase, 60 cycle, generator direct connected and driven by a 520 BHP, 4 cylinder, 200 RPM, Busch Sulzer Diesel Engine. Complete unit includes belt driven exciter, Ingersoll Rand compressor, oil cooler and filter, voltage regulator and panel board.

THE MOTOR REPAIR AND MANUFACTURING CO.
1556 Hamilton Ave. Cleveland 14, O.

BOILER

404 HP—375# Pressure 675°F Springfield complete with soot blowers, flow meter, CO_2 meter Bigelow walls, induced draft fan and stack, cat walks, oil & gas burners, etc.

F. W. HAY & COMPANY
2734 CHERRY STREET
KANSAS CITY 8, MO.

3 Phase, 60 Cycle Motors

SQUIRREL CAGE — 220/440 V.

1— 35 HP,	WEM, Nema	1200, BB
1— 30 HP,	GE-K, Nema	900, BB
1— 50 HP,	WEM, CS Nema	900, BB, HT
3— 25 HP,	WEM, CS Nema	900, BB, HT
1— 50 HP,	WEM, CS	1200, sleeve
1— 35 HP,	WEM, CS	1200, sleeve
1— 75 HP,	WEM, CS	1200, sleeve
1— 75 HP,	GE-KT	1800, sleeve
2— 75 HP,	GE, I-K	1200, sleeve
2— 75 HP,	WEM, CS	690, sleeve
1— 50 HP,	GE, KT327	1800, sleeve
1—100 HP,	GE, KT543	1800, sleeve
1— 60 HP,	GE, KT	900, sleeve
1—100 HP,	GE, KT556	900, sleeve
1—150 HP,	WEM, CS	1200, sleeve
1—150 HP,	GE, IE13	1200, sleeve
1—200 HP,	WEM, CS	1200, s. sleeve
1—125 HP,	F. B. Morse	1800, sleeve
1—100 HP,	GE, I-K	600, sleeve
1— 50 HP,	WEM, C	690
2—200 HP,	WEM, CS	1750, sleeve
1—200 GE,	KT559	1800, sleeve
1— 50 HP,	GE, K, Nema	1800, BB
1—125 HP,	GE, K, Nema	900, SP, BB
1— 60 HP,	GE, FTR533	800, BB
1—500 HP,	GE, I-K	900, sleeve
1— 50 HP,	WEM, CS	600, sleeve
1— 50 HP,	WEM, CS	900, sleeve

2200 VOLT

1—150 HP,	GE, IE13	1200, sleeve
1—150 HP,	WEM, CS	1200, sleeve
2— 75 HP,	WEM, CS	1200, BB
2— 75 HP,	WEM, CS	690, sleeve

STARTING EQUIPMENT

1—CR1034 K17,	200 HP,	2200 v. hand	
1—NR5048N13	150 HP,	2200 v. hand	
1—CR1034F1A	150 HP,	2200 v. hand	
1—CR7051-L2	50 HP,	2200 v. automatic	
1—CR7052Y-1	150 HP,	2200 v. automatic	

NON-REVERSING, REVERSING AND FULL MAGNETIC CONTROLS AVAILABLE:

2—150 KVA,	GE,	4000 P.,	230/460 sec.,	OISC transformer
1— 37½ KVA,	WEM,	2300 P.,	115/230 sec.	OISC transformer
1— 37½ KVA,	GE,	2300 P.,	230/460 sec.	OISC transformer
1—150 KVA,	GE,	4000 P.,	115/230 sec.	OISC transformer
3— 15 KVA,	GE,	4000 P.,	230/460 sec.	OISC transformer

SLIP RING, CONTINUOUS, 220/440

4— 20 HP,	GE, MT522	900, sleeve
2— 20 HP,	Ideal, AV	1200, BB
1— 25 HP,	GE, MT444	900, sleeve
2— 30 HP,	GE, MT536	900, sleeve
1— 50 HP,	WEM, CW658A	900, sleeve
1—150 HP,	WEM, CW868A	690, sleeve
1—150 HP,	WEM, CW575	600, sleeve
1—150 HP,	GE, I-M	450, 3 bearing
1—400 HP,	GE, I-M	450, 3 bearing
1—100 HP,	GE, I-M	600, sleeve
1— 50 HP,	GE, MT	690, sleeve
2— 75 HP,	GE, MT	900, sleeve
1— 25 HP,	WEM, CW	1200, sleeve
1— 30 HP,	GE, MT	1200, sleeve
1— 35 HP,	GE, MT	1200, sleeve
1—7½ HP,	GE, I-M	900, sleeve
1— 15HP,	GE, I-M	1200, sleeve
1— 15 HP,	GE, MT	1200, sleeve
1—300 HP,	GE, I-M	900, sleeve
1—200 HP,	GE, I-M	600, sleeve
1— 75 HP,	WEM, CW	1200, sleeve

SLIP RING, CONTINUOUS, 2200 VOLT

1—150 HP,	WEM, CW	600, sleeve
1—100 HP,	GE, I-M	600, sleeve
2— 75 HP,	GE, MT	900, sleeve
1— 50 HP,	GE, MT	690, sleeve
1—400 HP,	GE, MT	352—440, 3 bearing
1—200 HP,	GE, I-M	600, sleeve
1—550 HP,	Allis	900, sleeve
2—300 HP,	GE, MT	1800, sleeve
1— 25 HP,	Triumph	1200, sleeve
2— 30 HP,	GE, MT	900, sleeve

SLIP RING, HOIST DUTY

2— 50 HP,	MTC	850 rpm
1—125 HP,	MTC	690 rpm
1—150 HP,	ITC	690 rpm
2— 75 HP,	ITC	900 rpm
1— 15 HP,	MTC	900 rpm
1—600 HP,	WEM, CI	685 rpm
1—300 HP,	GE, I-M	440–220 volt

E. P. DIETRICK, 829 Richmont St., Scranton 9, Pa.

CENTRIFUGAL PUMPS

Rebuilt and Guaranteed

2—Warren 20"x16", Size 20, Type 16DL 8500 GPM, 45' Head, complete with 125 HP 440/3/60 870 RPM Motors.

1—Dayton-Dowd Type CSLH 10"x10", 2000 GPM, 118' Head, complete with 75 HP 440/3/60 1800 RPM motor.

1—Dayton-Dowd, Type CSLH 10"x12", 3000 GPM, 130' Head, complete with 125 HP 440/3/60 1800 RPM motor.

2—Dayton-Dowd, Type CSLH 12"x14", 5000 GPM, 130' Head, complete with 200 HP 440/3/60 1800 RPM motor.

3—Goulds All Bronze 4"x3" 2-stage 400 GPM 150' Head 1750 RPM, 25 HP 1750 RPM motor.

1—Allis-Chalmers Type S all Bronze 6"x5" 1000 GPM, 230' Head, 100 HP 1750 RPM motor.

C & S MACHINERY CO.
715 Howard St. St. Louis 6, Mo.

TRANSFORMERS

3—100 KVA Westinghouse Transformers. 13800 Primary voltage, 230-460 secondary voltage, 60 cycle, oil bath type, with percentage taps. Excellent condition. Available for immediate delivery.

THOMPSON CRUSHED ROCK CO.
R. R. #2 Kansas City, Kansas
Telephone ATwater 0335

FOR SALE

3—6 cylinders 12½ x 13 Alco Diesel Engines, direct connected through fluid couplings to Electric Machinery Co., 450 KVA, 440 volt, 3 phase, 60 cycle, 514 RPM generators, complete with automatic synchronizing panels and motor generator excitors, auxiliary equipment compressors tanks, heat exchangers, etc. to make complete plant if purchased together. Spare parts also. These units built in 1943 and are in excellent condition.

LINCOLN INDUSTRIES, INC.
DAMASCUS, VIRGINIA

FOR SALE

4-Superheaters

for 519 HP water tube Heine boilers, purchased new in 1942. Located at our siding, Lewiston, Maine. Price as is, where is, $1,000 for lot or make an offer.

CENTRAL MAINE POWER COMPANY
9 Green Street, Augusta, Maine

ELECTRICAL EQUIPMENT

NEW & USED—(IN EXCELLENT CONDITION)

For Immediate Shipment

1 Lot of new and used 37 K.V. air brake switches 200 to 600 amp.

1 Lot of new and used 7.2 K.V. side operating air brake switches.

1 Lot of 37 K.V. 200 to 600 amp. single blade disconnects.

1 Lot of 7.2 to 15.0 K.V.—300 amp. to 1500 amp. single and double blade both single throw and double throw disconnects.

1 Lot of solenoid operated switches closing mechanisms for 37 to 67 K.V. oil switches.

1 50 K.W. D.C. exciter 125 volt.

1 Motor-Generator set—150 K.W.—550 volt. Generator direct connected to 220 HP-2300 volt open motor. This set complete with D.C. Control Board and motor starting equipment ready to operate.

1 Lot of Hi voltage Bus support insulators, new and used. 7.2 K.V. to 67 K.V. Approximately 300 in this lot. These are all complete with Bus clamps and supporting pins to mount on steel structures.

OTHER MISCELLANEOUS ELECTRICAL EQUIPMENT.

Lancaster Electric Service Co.

510 East Main Street — *Phone 4400* Lancaster, Ohio

I. C. SHAFFER, *Manager*

50% SAVING

DIESEL ENGINES,
671, 278A, 258S

MOTOR GENERATORS
20, 30, 60, 100 KW, AC or DC

L.C.I., L. S.M. and P.C.
all equipped, Winches

Your inspection invited. Sold "as is," or in guaranteed running condition. Subject to prior sale.

GUS KONUGRES & CO.
2033 W. 7th St., Los Angeles 5, Calif.
Phone FAirfax 4046

TRANSFORMERS

QU.	KVA	MAKE	FORM	TYPE	HV	LV	PH
96	1½	Maloney	Dry	TF5V	480/240	120/240	1 new
32	3	G. E.	KR	H	7200/12470Y	120/240	1
6	3	Whse.	Dry	AJR	230/115	230/115	1 new
22	5	G. E.	KR	H	7200/12470Y	120/240	1
6	7½	G. E.	KR	H	7200/12470Y	120/240	1
24	10	G. E.	KR	H	7200/12470	120/240	1
2	10	Al. Chal.	Dry		440	110	1 new
18	15	G. E.	KR	H	7200/12470	120/240	1
2	15	Maloney	Dry		440/220	220/110	1 new
33	25	G. E.	KR	H	7200/12470Y	120/240	1
1	25	G. E.		H	440	220	3
3	25	G. E.	Dry		440	110	1 new
48	37½	G. E.	KR	H	7200/12470Y	120/240	1
3	37½	Whse.	Dry	AJR	440	110	1 new
3	50	G. E.	KR	H	2400/4160Y	120/240	1
2	50	G. E.	Dry	75G	440	120	1 new
58	50	G. E.	KR	H	7200/12470Y	120/240	1
3	75	G. E.	KR	H	7200/12470Y	120/240	1
4	100	G. E.	KR	H	7200/12470Y	120/240	1
1	100	Niagra	OISC		22000	2200	3 new
1	150	Niagra	OISC	H	33000	3300	3 new
4	150	Uptegraff		OISC	30000	3300	3 new 25 cy.
5	300	Upt graff		OISC	33000	7200/12470Y	3 new
3	333	Maloney	OISC		11000	2300	1
3	500	Whse.	SL	OISC	2400	240/480	1 new
4	1000	Whse.	SL	OISC	44000	11000/9990	1
6	1500	Wagner	BGSS	17RRB	44000	6900/11950Y	1 new

The above represents one of the largest dealer stocks in the United States. We have them; also others. If you don't see listed what you want please wire or write.

1350—45 ft. Western Cedar poles, cross arms and insulators.

10—90/135 volt, 1 ph, 60 cy, Cat 69G102, 110/115/120 volt output, GE voltage stabelizers, NEW.

1—40 KW, 60 V, DC, GE, dir. dr. 60 HP, 1200 RPM, 440 V, Type TS, GE Synchron. motor, MG set with control and starting.

1—125 KW, 250 V, 860 RPM, GE M-G set with 440 V Sq Cg. motor.

2—400 KW, 550 V, 600 RPM, MP, DC, GE, M-G sets with 600 HP I-K, GE, 2300 Volt motors, starters, control.

2—350 H.P., 4000 Volt, CR1034G1A, 3-60, GE Compensators.

2—1000 Lb. pressure, 500 GPM, 8 stage Goulds pumps with motors.

86—5 to 1, 5 HP, Type 3750H, W. A. Jones, Speed reducers, new.

1—25 Ton, 38 Ft. Rad., Willey stiff leg derrick, Jaeger double drum hoist, UD18 Int. diesel engine, nearly new, 50 ft. boom.

3—500 Amp, 440/220, AC, Westinghouse Stabel-Arc Welders.

2—1½ Bbl., 15/7½ HP Peerless Dough Mixers, nearly new.

MOTORS - GENERATORS - TRANSFORMERS - BOT - SOLD - RENTED

WAYNE ELECTRIC & MFG. CO.,
344 West Eighth South St., *PH. 5-5224* Salt Lake City, Utah

FOR SALE

Ready for IMMEDIATE Delivery

2—Babcock & Wilcox Type E, Size 23, Class 221 BA Direct Fired COAL PULVERIZERS, capacity 4250 lbs. pulverized bituminous coal per hour, with Motors. Excellent condition. Outfits installed in 1942 for Standby Service and in operation less than six months. Wire or write for full details.

FS 6609, Power
330 West 42 St., New York 18, N. Y.

FOR SALE

1—G.E. 4 stage, 175 lb. condensing, 2500 K.V.A. 2300 volt turbo generator complete with auxiliary equipment.

1—G.E. mixed pressure, 140 lbs. 16 A.B.S. condensing, 750 K.V.A., 2300 volt turbo generator complete with auxiliary equipment.

The above turbo generators will be taken out of service in October, 1948 and can be inspected under load in the meantime.

FS-6599, Power
520 North Michigan Ave., Chicago 11, Ill.

FOR SALE

FAIRBANKS MORSE DIESEL ENGINE GENERATING PLANT

	ENGINES			GENERATORS				
Number	H P	Type	RPM	KVA	Volts	Cycle	Phase	Make
2	150	YV	257	60	230	60	3	F-M
1	100	YV	257	72	230	60	3	F-M
1	75	YV	300	62.5	240	60	3	West
1	210	VA	300	150	240	60	3	West

ALL NOW OPERATING AND IN GOOD CONDITION. PRICED LOW FOR QUICK DISPOSAL.
F.S.-6796, Power, 330 West 42nd St., New York 18, N. Y.

Best buy in

DIESEL POWER PLANTS

ideal for 500 to 900 KVA generators

as low as $3500.00

GM 12-567

900-1000 HP.....600-720 RPM

THE LEARNER COMPANY

ft. of Stanford St. Alameda, California

1—**Allis-Chalmers** 333KW AC **Generator,** 220 volts, 1000 amperes, 0.8 P. F. 60 cycle, 3 phase, 150 RPM, with shunt wound 20 K.W. excitor. Direct connected to **Allis-Chalmers** condensing horizontal cross-compound **Corliss Engine,** 22.6# steam/hr. at rating. High pressure cylinder 18" x 30"—150 RPM. Low pressure cylinder 32" x 30"—throttle pressure 140# gauge—operating to 26" Hg. vacuum. 13' dia. x 10" balance wheel. **Nugent oiling system. Worthington Surface Condenser** 770 sq. ft. **Marsh Vacuum pump** 8" x 12" x 12" **Never Used. Field Rheostat.**

1—**General Electric** 140 KW AC **Generator** 220 volt, 421 amp. 0.8 P. F. with 9½ KW compound wound D.C. exciter 115 volt direct connected to non-condensing 18 x 18 **Skinner** Uniflow—center crank **Engine** 140 KW. 7' x 18" balance flywheel. 140# operating pressure. 5# back pressure. **Field Rheostat.**

Fitzgibbons Boiler Company, Inc.

P. O. BOX 94 OSWEGO, NEW YORK

FOR SALE

One—80 H. P., D. C., 230 volts, 450 RPM, Compound Interpole, Crocker Wheeler, Size 101-H, Type CCM, Ser. #485267, with Slide Base and Control.

In excellent condition. Full commutator.

C. V. HUNT, INC.

529-531 Church St. Ridgefield, N. J.

ELECTRIC GENERATOR

1 New Automatic Kohler Electric Generator, Model No. 5E52, 5 KVA, 230 volts, 3 phase, self-contained. Never used. Save 20% on today's price.

WHEATLAND TUBE COMPANY

WHEATLAND PENNSYLVANIA

FOR SALE

SYN. MOTOR, ENGINE TYPE

600 H.P. 200 R.P.M. 2200 Volts, 3 phase, 60 cycle unity power factor with auto-transformer, 3—15 KVA, 6600 to 230/460 Volt, 1 phase, 60 cycle distribution transformers.

W. L. STEVENS, ELECTRICAL ENGINEERS

75-8th Street, New Westminster, B. C., Canada

FOR SALE

Three—200 KVA Skinner Uniflow Engine Generator Sets with complete panel board, and voltage regulator.

Steam Engine 22" x 21" simple horizontal center crank, with extension base and outboard bearing for generator.

Generator rotor mounted on crankshaft for 220 volts, 3 phase, 60 cycle.

12 KW exciter—belt driven.

Condition good. Will sell, as is, on foundations.

Make us an offer.

WESTERN AUTOMATIC MACHINE SCREW CO.

ELYRIA, OHIO

IF THERE IS

Anything you want

that other readers of this paper can supply

OR—

Something you don't want

That other readers can use, advertise it in the

SEARCHLIGHT SECTION

LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946

Of Power, published monthly at Albany, N. Y., for October 1, 1948.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. A. Gerardi, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publisher of Power, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), printed on the reverse of Form 3526, to wit:

1. That the name and address of the publisher, editor, managing editor and business manager is: Publisher McGraw-Hill Publishing Company, Inc.; Editor, Philip W. Swain; Managing Editor, L. N. Rowley; Business manager, N. O. Wynkoop, all of 330 West 42nd St., New York 18, N. Y.

2. That the owner is: McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 18, N. Y. Stockholders holding 1% or more of stock: Curtis W. McGraw, Executor of the Will of James H. McGraw, 330 West 42nd Street, New York 18, N. Y.; James H. McGraw, Jr., 330 West 42nd Street, New York 18, N. Y.; James H. McGraw, Jr., Curtis W. McGraw and Willard T. Chevalier, Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw and Curtis W. McGraw, all of 330 West 42nd Street, New York City; Edwin S. Wilsey and Curtis W. McGraw, Trustees for James H. McGraw, 3rd, Madison, New Jersey; Curtis W. McGraw, Donald C. McGraw, both of 330 West 42nd Street, New York City; Mildred W. McGraw, Madison, New Jersey; Grace W. Mehren, 536 Arenas St., La Jolla, Calif.; Jacob L. Hain, 1 North 5th Street, Reading, Pa.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

J. A. GERARDI, Secretary.

McGRAW-HILL PUBLISHING COMPANY, INC.

Sworn to and subscribed before me this 29th day of September, 1948.

[SEAL] ELVA G. MASLIN.

(My commission expires March 30, 1950.)

COMPLETE POWER PLANT

AVAILABLE IMMEDIATELY

Plant consists of 2-481 H.P. 250 lb. W. P. 100% super Heat Springfield Boilers—and includes pulverizing equipment. Boilers are set for 200% of rating.

Plant includes—2-750 KW Ford Turbo generating units. 3 Ph. 60 cycle—2300 Volts condensing type.
1-75 KW Turbo generator 3 Ph. 60 cycle—2300 volts.
All Auxiliary Boiler Room Equipment including Feed Pumps. Heats and miscellaneous motors.

Plant was installed in 1926, shut down in 1934 and operated monthly during shut down periods. All equipment has been maintained. In exceptionally fine condition.

Boiler equipment is ASME and Natl. Board.

WARNER J. SHERB INC.

342 MADISON AVE. NEW YORK 17, N. Y.

MURRAY HILL 2-9098

FOR SALE

INTERNATIONAL FULL DIESEL ENGINE with 30 KW 3 phase 220 v. generator direct connected exciter. Fully automatic. Portable. New.

25 KW M-G set, 40 H.P., 1209 r.p.m. 220/440 v. motor, 250 v. 2 wire D.C. generator.

ERIE BALL 11" x 18" R.H. side crank Steam Engine to Allis-Chalmers 60 K.W., 277 r.p.m., 220 v. 3 ph. 60 cy. generator.

SKINNER ENGINE 15" x 15" dir. con. to G.E. generator type TRE, 100 KW., .8 p.f., 240 v., 276 r.p.m. 3 phase, 60 cycle.

B.-H. ELECTRIC CO.
640 W. Grand Ave. Chicago 10, Illinois

FOR SALE

MODERN 1000 KW Turbo-Generator

in Excellent Condition

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker, and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

NEWMAN & COMPANY, INC.
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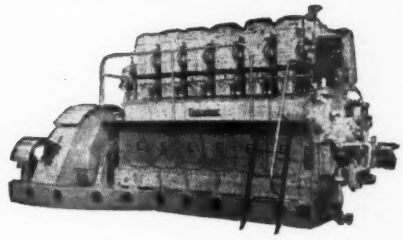

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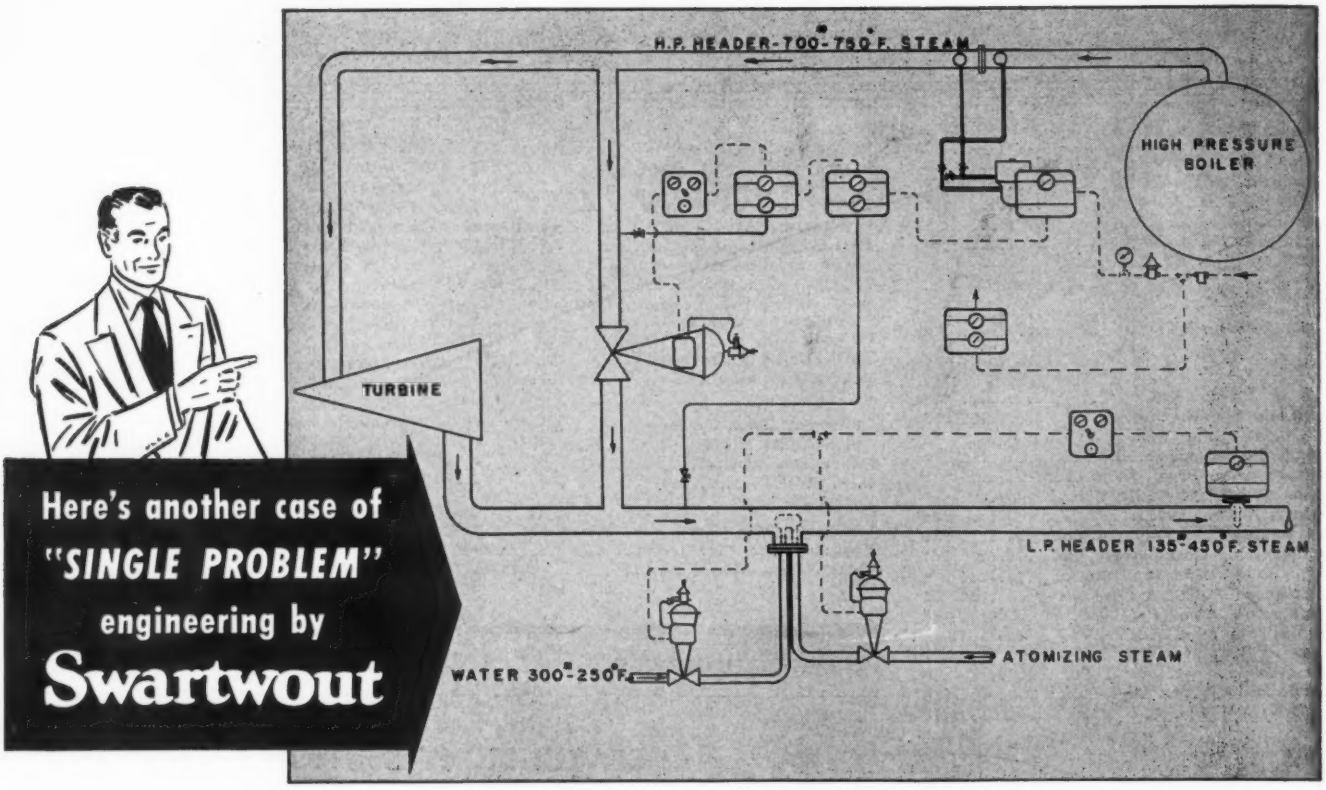

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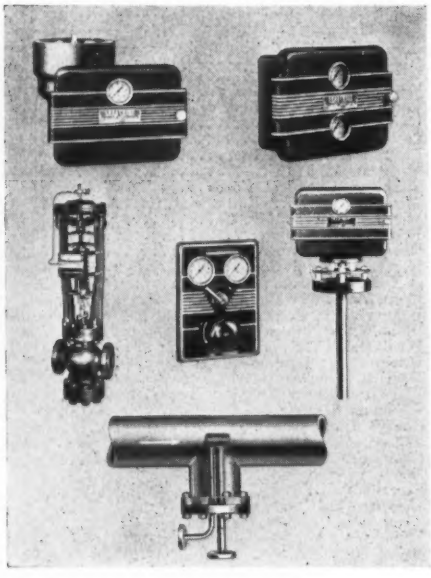

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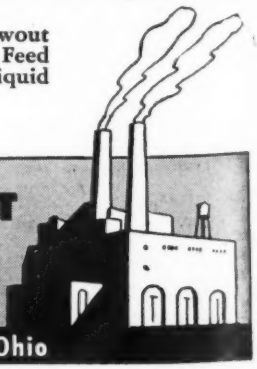

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(Split Ring Type)

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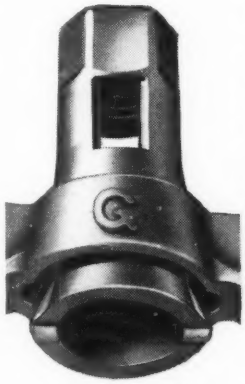
- When weight is returned, patented swivel shank locks automatically, preventing change of adjustment due to vibration. Wire retaining ring prevents separation of the swivel shank from the pipe ring or yoke . . . makes assembly a single unit.
- 12 sizes have load range of 80 lbs. for ¾" size to 1510 lbs. for 8" size. May be used in connection with practically any building attachment.



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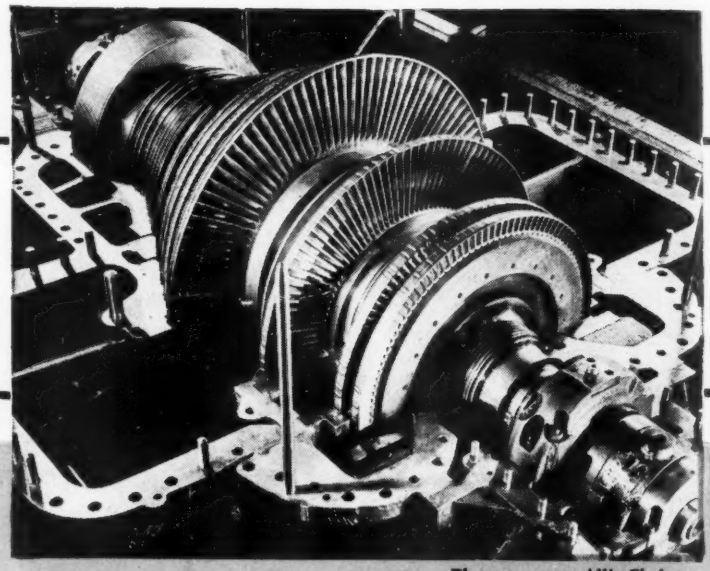

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